TABLET MANUFACTURE

ITS HISTORY, PHARMACY AND PRACTICE

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PREFACE

The many difficulties constantly presenting themselves to the author and his assistants in the manufacture of tablets, and the marked absence of literature relating to the subject, have led to the preparation of this little volume.

While an attempt has been made to treat the subject broadly, its nature is such as to demand the consideration of details.

Special attention has been given to causes and remedies of difficulties encountered in manufacture, such as capping, picking, and sticking. Also, to the methods of treatment of individual substances.

The demand for tablets which will disintegrate in water has radically changed methods of granulation in recent years, and this important subject has been treated in detail.

It has been deemed best to omit consideration of sugar- and chocolate-coating because of the doubtful utility of giving directions without practical demonstration.

Embodying, as it does, the results of practical work, not only in a large but also small way, it is hoped that this volume will be found of equal service to the retail pharmacist who may have occasion to make but few tablets and to the larger manufacturer.

The author is indebted to Mr. W. Henry Rivard and Mr. B. Douglass for many valuable suggestions; to Mr. H. N. Fraser and Messrs. John Wyeth and Brother for historical data; and to F. J. Stokes Machine Co., The J. H. Day Co., Whitall, Tatum Co., and H. K. Mulford Co. for the loan of electrotypes.

J. R. W.

New York,
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CONTENTS

CHAPTER I

HISTORY

CHAPTER II

INTRODUCTION

CHAPTER III

TRITURATING

CHAPTER IV

MIXING, GRANULATING, AND DRYING

CHAPTER V

LUBRICATING

CHAPTER VI

COMPRESSING

5

LIST OF ILLUSTRATIONS.

TABLET MANUFACTURE

CHAPTER I

HISTORY

THE present era of compressed-tablet making dates back but a few years,[1] and during this period the quality of the tablets, as made by the highest exponents of the art, has gradually improved until it has reached a high standard. In the early stages, the chief problem was to construct a machine which would economically compress powders or granulations. When, after a number of years, this was accomplished, compressed tablets were on a commercial basis; that is,

[1] "Stamps have been found in England which have been shown to have been used by the Romans to stamp remedies for producing clearness of vision, or for doing away with dimness of sight. The object aimed at by the medicament was specified in the stamp. It is noteworthy that the stamps so far discovered were designed for remedies for ocular diseases. The preparations were hardened with gum or some viscid substance and were thus ready to be liquefied at any time. Thus our supposedly very modern device of triturates or compressed tablets is only a revival of an ancient Roman custom." (American Medicine.)

they could be made to sell at a profit to the manufacturer. From that time to the present, countless different machines have been constructed, many of them cumbersome and defective in other ways, until to-day a number of machines are well-nigh perfect.

The early tablets (and, unfortunately, many of to-day may be classed with them) were compressed hard, and made without reference to their solubility or to their power to disintegrate, and little skill was required in their preparation. On the other hand, the proper manipulation of the medicinal ingredients, and the choice, proportioning, and manipulation of excipients best suited to use with the different formulas, require a considerable degree of skill, as well as an intimate knowledge of the physical and chemical properties of the ingredients. During the past fifteen years, a great advance has been made in respect to solubility and disintegration of tablets, and at the present time there are on the market many tablets closely attaining perfection.

Compressed tablets are believed to have been made first in 1844, by Professor Brockeden, in England, who, in using a machine for

the compression of lead for use in pencils, conceived the idea that the same principle could be applied to the compression of drugs and chemicals into tablet form. He thus compressed potassium bicarbonate and sodium bicarbonate. These tablets had a considerable sale both in England and in this country, where they were sold by Mr. Frederick Brown, of Philadelphia.

In 1871 Professor Brockeden's business was purchased by the Messrs. Newbery.

About this time, Mr. Jacob Dunton, of Philadelphia, began to compress a variety of formulas, including quinine tablets, on a machine of the Brockeden pattern.

Shortly after this, about 1872, Messrs. John Wyeth and Brother, in conjunction with Mr. Henry Bower, succeeded in producing a machine which, while still a hand-press, was so much of an advance over the previous patterns, that the cost of compression was materially reduced, and the resulting tablets were successfully exploited.

Since that time, the preparation of compressed tablets has been taken up by a host of manufacturers and pharmacists.

The manufacture of moulded tablets is a still more modern art. The idea of filling moulds with medicated milk sugar was first proposed by Dr. Robert M. Fuller, of New York, who, on February the twenty-first, 1878, read a paper presenting the subject before the American Medical Society. Some time later, Dr. Fuller laid the details before Mr. Horatio N. Fraser, who was at that time in charge of the prescription department of a large New York pharmacy. Dr. Fuller requested that nothing concerning the tablets or their manufacture be made the subject of a patent, in order that all pharmacists should be free to make the tablets.

After vain attempts to induce his employers to embark in the new enterprise, Mr. Fraser started, in 1883, in an extremely modest way, to manufacture moulded tablets; with what result, every pharmacist knows.

It is worthy of note, that, after more than twenty years, inventors have yet to perfect a machine which will successfully replace the moulds of hard rubber and the spatulas with which the best tablets are still made.

CHAPTER II

INTRODUCTION

COMPRESSED TABLETS (abbreviated C. T.) are small bodies made by the compression of medicinal substances by appropriate apparatus, usually a compressing machine. They are of various shapes: cylindrical, square, octagonal, oval, etc., and with convex, flat, or other form of upper and lower surfaces. The usual form is cylindrical, with convex upper and lower surfaces. They range in size from one-eighth inch in diameter to three-fourths inch or more. Those having a diameter of 7–32 inch or less are termed Compressed Triturate Tablets (C. T. T.), and in most cases contain one grain or less of medicament. Tablets having properties characteristic of lozenges are termed Compressed Lozenges.

Properly made Compressed Tablets possess the following properties:

1. Accuracy of dose.
2. Perfect subdivision of ingredients.
3. Uniformity in weight and appearance.

4. Rapid solubility if composed of freely soluble substances.

5. Rapid disintegration when immersed in tepid water, if composed of difficultly soluble or insoluble substances.

6. Sufficient firmness to prevent crumbling or wearing away of edges when ordinarily handled.

Most compressed tablets require in their preparation a certain routine, briefly described as follows: The ingredients are mixed, moistened, forced through a sieve to form granules, and dried. The dry granulation is then lubricated and compressed into tablets.

These steps are conveniently considered separately and will be taken up in order:

1. Triturating.
2. Mixing, Granulating, and Drying.
3. Lubricating.
4. Compressing.

CHAPTER III

TRITURATING

VARIOUS forms of triturating mills and mixers for powders have been devised and are in use. The principal forms are four in number, namely: 1. Mortars and Pestles. 2. "Powder Mixers." 3. Ball and Pebble Mills. 4. Chasers.

1. Mortars and Pestles

These are preferably of the regular wedgewood variety. They will perform the work of most other forms of triturators, provided sufficient time and energy are expended. They are, in fact, not only as necessary to the large manufacturer as to the small, but with them the pharmacist is equipped to produce as perfect triturations, in small lots, as with the more costly apparatus. The other forms of triturators are necessary to the larger manufacturers because of their labor-saving qualities, and as a check against imperfect trituration when working with large quantities of material.

Mortars and pestles are adapted to connection with power. (See Fig. No. 1.) The mortar is fastened to the top of a short vertical

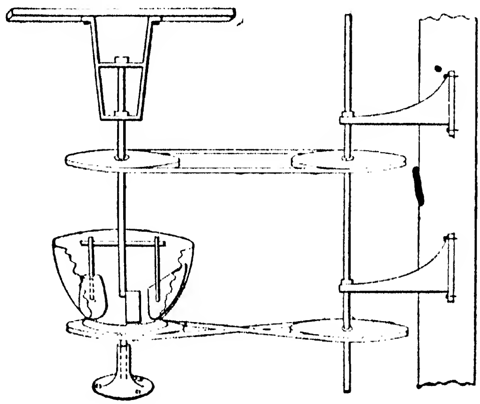


FIG. No. 1
Power Mortar

shaft, which is made to revolve in a socket. Above the center of the mortar is another vertical shaft, to which the pestle and scraper are attached on opposite sides. Each shaft is supplied with a grooved pulley belted to corresponding pulleys on a countershaft. By the use of one "straight" belt and one "twist" belt the mortar revolves in one direction and the pestle and scraper in the opposite. This

mortar mill is very serviceable in reducing hard crystals, old tablets, etc., to impalpable

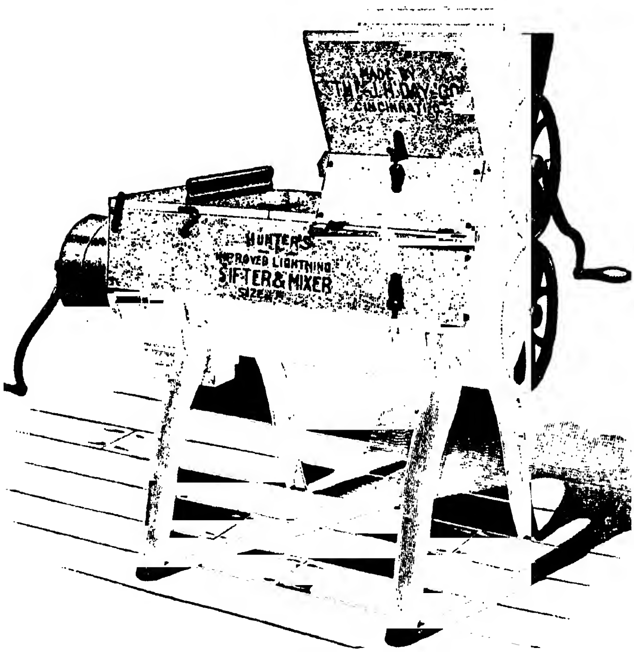


FIG. No. 2
Hunter's Sifter and Mixer

powder, as well as for triturating. A one-gallon mortar thus equipped will grind about

two pounds of average dry material of the above or similar nature to a fine powder in about an hour.

2. Powder Mixers

These are of various forms, the essential features of which are a semi-cylindrical trough with a hinged, box-shaped cover, and a light metallic spiral arranged to revolve within. Mixers of this form sometimes have an attached sieve; the combined action of the sieve and spiral serve to produce an even trituration in a short space of time. A typical machine is shown in Fig. No. 2. These mixers are adapted to triturating approximately equal quantities of powders required in making such tablets as Alkaline Antiseptic, Ammonium Chloride Comp., etc. They are not so well adapted to making triturations of poisons as are pebble mills or chasers. A small form of powder mixer is shown in Figure No. 3. The capacities of these styles range from about five pounds to several barrels.

3. Ball and Pebble Mills.

Ball and Pebble Mills are revolving hollow cylinders of iron, steel, or porcelain, contain-

ing a number of balls of the same material, about one and a half inches in diameter. By the constant tumbling and rubbing of the balls, the substances in the mill are reduced to fine powder and intimately mixed. The balls are readily freed from powder by the use of a coarse sieve. This form of mill is particularly useful in powdering or triturating substances of a hygroscopic, irritating, or poisonous nature, such as brittle extracts, capsicum, or corrosive sublimate. The covers are usually secured by means of clamps, over rubber gaskets, which render the mills practically air-tight. Thus, neither can atmospheric moisture affect the contents, nor can dust escape from within. Porcelain pebble mills are preferable to those of iron or steel for chemicals or other materials affected by iron, or liable to discoloration by contact with iron-rust, but are somewhat more expensive. Capacities of the porcelain mills range from one to fifty pounds, and those of metal from

Fig. No. 3
Small Sifter and Mixer

ten to several hundred. (See Figs. Nos. 4 and 5.)

The **Pot Mill** is a modification of the Pebble mill. The body is in the form of a large iron pot. From the center of the bottom projects a shaft fitted with bevelled gears. The pot revolves at an angle of about thirty degrees and contains three iron balls about four inches in diameter. A cover is provided, but as it does not fit so tightly as in the pebble mill, this form of mill is not so serviceable for use with hygroscopic or irritating substances. It is, perhaps, the most easily cleaned and operated mill in use, which commends it. Capacities range from about ten to thirty pounds. (See Fig. No. 6.)

4. Chasers.

Chasers are a modified form of mortars and pestles, with scrapers. A heavy stone roller rotates on a shallow, flat-bottomed stone mortar, which is usually from two to four feet in diameter and from six to twelve inches in depth. The roller and sides of the mortar are constantly scraped when the former is in motion. This mill is unexcelled for uniformly triturating dry substances which are

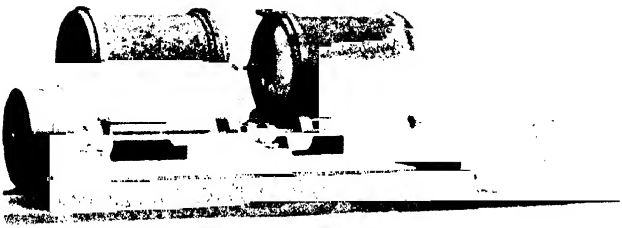


Fig. No. 4
Pebble Mill
Porcelain [illegible] container

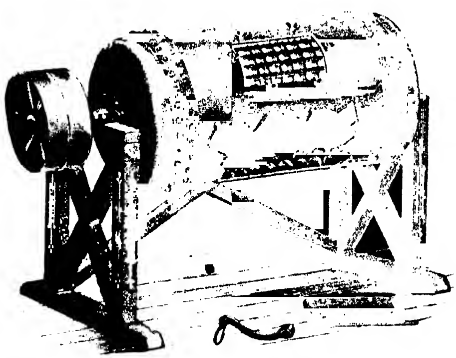


Fig. No. 5
Steel Ball Mill

Fig. No. 6
Pot Mill

at least partially powdered, and of such a nature as not to cake upon the application of pressure. About half an hour suffices to mix a charge, which may range from five to fifty pounds, depending upon the size of the mill and the character of the ingredients. Chasers should be provided with dome-like, close-fitting covers of sheet iron or similar material.

It should not be inferred that the mills above described are adapted only to making triturations for tablets. They are all primarily made for other purposes, and incidentally are applicable to tablet-making. Thus, as the manufacturer of tablets usually produces other pharmaceuticals, a mill can often be made to serve both departments with economy, when for one department only the expense would not be warranted.

Two points of great importance in tablet-manufacture are often overlooked. First, the use of powders of the greatest possible degree of fineness, and, second, absolutely perfect mixture or trituration. It is in the production of these conditions that the various forms of mixers and triturators serve.

A fine powder (at least a number 60, better 100) is essential to the formation of an even color in the finished tablet, when substances of different colors or shades enter into its composition. A coarser powder produces a mottled and unsightly appearance, which militates against the tablet in the eyes of both physician and patient.

The necessity for perfect trituration of ingredients is obvious. The means of obtaining this condition follow a well-defined procedure. It is not enough simply to "put in the powders and triturate until mixed." The U. S. Pharmacopœia, in the directions for making "Triturations," gives the procedure which should be followed in all cases, modified to suit the particular formula:

"Take of

The Substance	10 gms.
Sugar of Milk	90 gms.
To make	100 gms.

"Weigh the Substance and the Sugar of Milk separately; then place the Substance, previously reduced, if necessary, to a moderately fine powder, in a mortar; add about an equal measure of Sugar of Milk, mix well

by means of a spatula, and triturate them thoroughly together. Then add fresh portions of Sugar of Milk, from time to time, until the whole is added, and continue the trituration until the Substance is intimately mixed with the Sugar of Milk, and reduced to a fine powder." U. S. P.

The superiority of this method is readily shown by preparing two triturations of the above formula, in which powdered charcoal or red mercuric iodide is used for the substance. Let one trituration be made strictly in accordance with the directions and the time noted, required to produce a color that appears uniform under a magnifying glass of about ten diameters. Let the other trituration be made by adding the whole of the coloring agent to the whole of the Sugar of Milk at once, and the trituration be continued for the same length of time as is expended upon the first mixture. It is scarcely necessary to point out the difference which will be observed between the two products, and the obvious advantages both in uniformity of the product and in saving of time, by the use of the official method.

CHAPTER IV

MIXING, GRANULATING, AND DRYING

In the manufacture of compressed tablets, the limitation of the tablet machines of the market must be taken into consideration. Their construction is dealt with in another place. Suffice it to say here that up to the present time machines have not been devised which will readily compress fine powders. All material to be made into compressed tablets must be in the form of uniformly coarse powder (about a number 12 to 20) before feeding into the machine. The process of converting powders and other substances into this condition is termed

GRANULATING

This is usually accomplished by moistening the powders with a suitable liquid, mixing, forcing the slightly damp mass through a sieve (about a number 12 to 20), which forms the granules, drying, and again sifting. This is a brief outline; the details are, perhaps, the most important part of the

manufacture of compressed tablets, and require the exercise of particular care and effort on the part of the maker who would produce tablets of excellence.

MIXING, GRANULATING, AND DRYING APPARATUS

Small lots are most conveniently moistened and mixed in mortars. Large lots may also be handled in portions in mortars. A suitable and convenient aid, however, is the mass mixer, such as is shown in Figure No. 7 or 8. It consists essentially of two spirals of heavily tinned iron, geared to revolve toward each other in an enameled iron box. The bottom of the box consists of two semi-cylinders joined together, in which the spirals revolve. With the occasional use of a spatula to scrape the spirals and box, the mass becomes perfectly moistened in a short time. Mass mixers are particularly useful for mixing solid extracts with powders. A steam-jacketed mixer is often of

FIG. No. 7
Hand Mixer

great assistance in quickly drying out

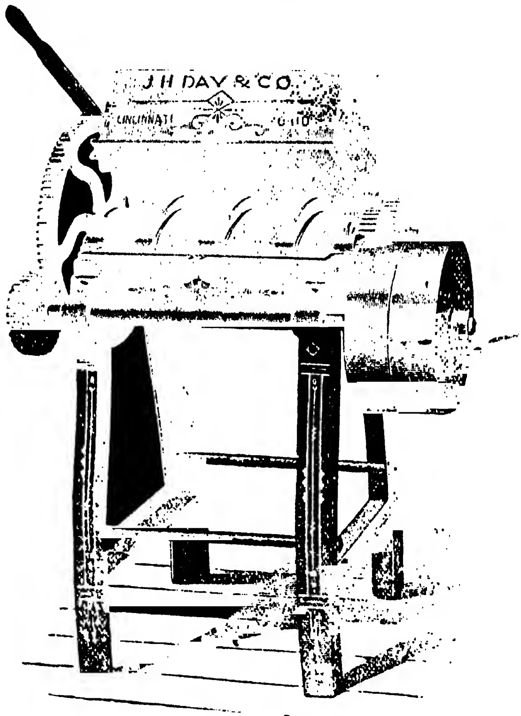
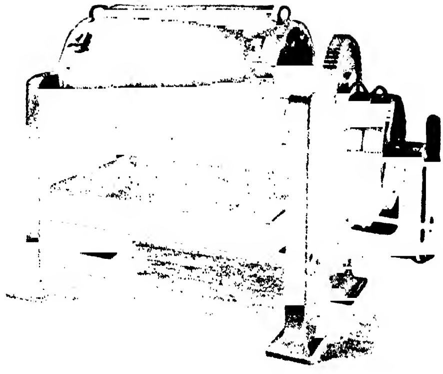


FIG. No. 8
Power Mixer

extract masses which would otherwise present great difficulty in drying; such, for



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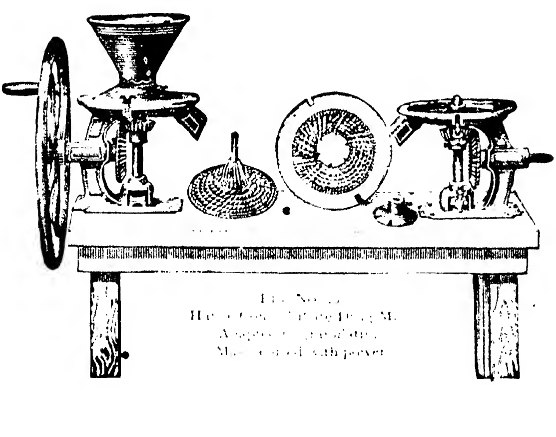


[illegible]
[illegible]
[illegible]
[illegible] with power

example, as Viburnum Comp., and Cystitis masses.

For the purpose of mixing substances such as those for effervescent tablets, in which massing together is to be avoided, another form of mixer is preferable. Instead of kneading, it whips the material in such a manner that it is kept in a light and granular condition. In fact, this style of mixer is adapted to the preparation of most compressed tablet mixtures, except those containing large proportions of extracts or other tenacious ingredients. Figure No. 9 illustrates an excellent form of this mixer, made by F. J. Stokes Machine Co., Philadelphia. Within the cylinder is a revolving shaft to which are attached spatula-like blades which lightly mix the material. In the trough at the top of the cylinder is placed the moistening agent, which gradually enters and evenly dampens the contents. The cylinder is held stationary when the machine is in operation, and is inverted after removal of the cover, to empty. This form of mixer is also admirably adapted to the preparation of effervescent salts.[1]

[1] See article by the author, "The Preparation of Effervescent Salts," Merck's Report, January, 1904, p. 6.

For the purpose of converting hard masses into granules, a mill is necessary. A suitable form is shown in Figure No. 10. Such a mill is furnished either with a fly-wheel for hand-operation, or with pulleys for power.

The large majority of granulations, however, are prepared by forcing the moistened material through a sieve. These are best made of brass wire, numbers 12, 16, and 20 mesh, fastened to a rectangular frame of one-half inch maple or other hard, close-grained wood. The sieves of the market are unsatisfactory for the purpose; they are too light in construction to withstand the strain and are not of a shape to facilitate ready handling of the material. A convenient size for the sieve-frames is 17 inches* long, 12 inches wide, and 4 inches deep. The wire cloth is cut 18 by 13 inches, folded over one-half inch on each end and side, and held in place on the frame by four strips of hard wood about one inch in "depth," screwed to the frame through the wire cloth. By this

* Seventeen inches is used because the wire "cloth" is made thirty-six inches wide. By cutting in half, two pieces each eighteen inches wide are obtained, allowing one-half inch to be turned over at each end.

construction the wire is readily replaced by new, when occasion demands. (See Figure No. 11.) When using the sieve for granulating purposes, it should be *inverted*. In this

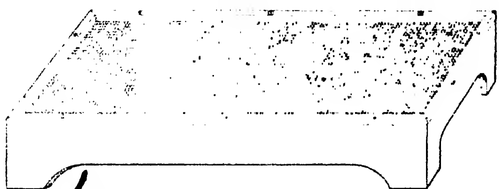


Fig. No. 11
Granulating Sieve

position sufficient space is beneath the wire to allow the granules, as they pass through, to fall freely and without injury upon the paper which should be under the sieve.

Small portions of moistened material are put on the sieve and forced through by the

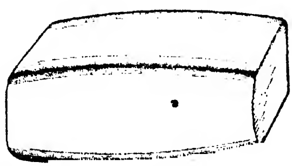


Fig. No. 12
Granulating Block

palm of the hand, or, preferably, by means of a hard wood block. Such a block should be

about 4 to 5 inches long, 3 to 3½ inches wide, and 2 to 3 inches thick, and somewhat convex on its large surface. (See Figure No. 12.)

Another very serviceable arrangement of sieves for granulating large lots of material

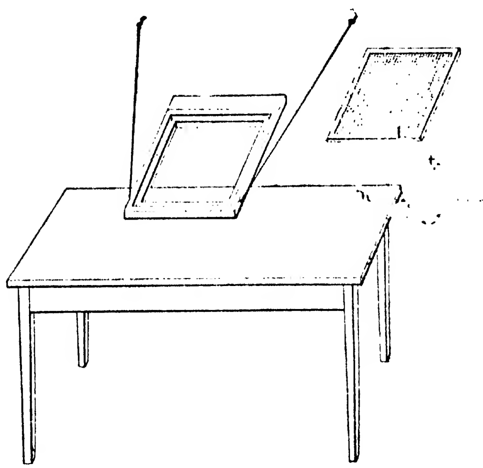


Fig. No. 13
Granulating Sieve, Interchangeable

is shown in Figure No. 13. The brass cloth may be fastened to the heavy wooden frame in the manner detailed above; or, better, it may be soldered to a frame of heavy sheet

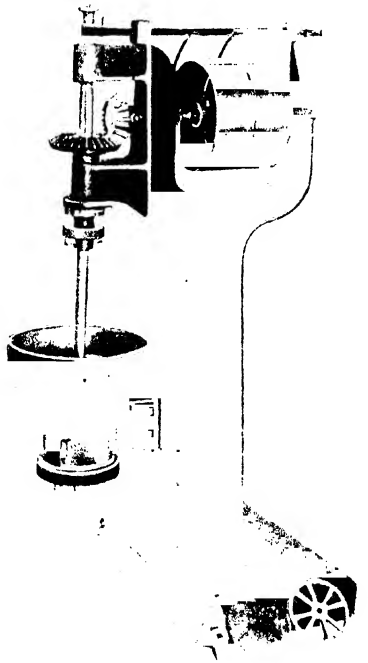
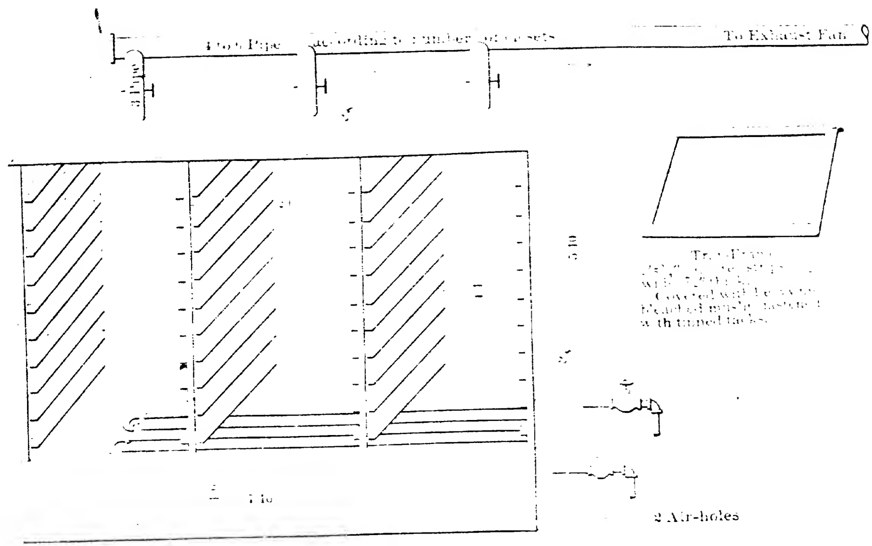


Fig. No. 11
Stokes Wet Granulating Machine



Top, front, back, and doors [illegible]
Partitions [illegible]
Cleats, 2 8" long [illegible] square [illegible]
Blocks 2" long, fastened [illegible] alternately [illegible] each tray,
with this [illegible] against [illegible] of trays
Doors, with T hinges [illegible]
Steam-coil, 6 to 8 1" pipe [illegible] May be replaced [illegible]

Fig. No. 1[illegible]
Drying Closets

brass, which sits in a recessed wooden frame. The latter is readily made to hinge on a cleat fastened to the wall. When in use it is held rigid by means of hooks or chains; when not in use it may hang down against the wall. It should be supported about eight inches above a table placed beneath it to hold trays for receiving the granules.

For the manipulation of large quantities, a granulating machine is useful. Figure No. 15 shows the Stokes' granulator, which is stated by the makers to have granulated 2,000 pounds of material in one day.

A drying-closet with free circulation of heated air is a necessity for the production of a line of tablets. On a very small scale and under the most favorable atmospheric conditions, some tablets can be made without resort to a dryer. As no dependence can be placed upon the weather, and as for many tablets a dryer is absolutely essential, it would be unwise to attempt their manufacture without its aid.

While ready-made drying-closets can be purchased, they are of doubtful utility. It is more economical and otherwise satisfactory, both for the pharmacist and large

manufacturer, to construct their own dryers.

Figure No. 15 shows the appearance of a series of closets which can be strongly recommended. Such a dryer can be made in

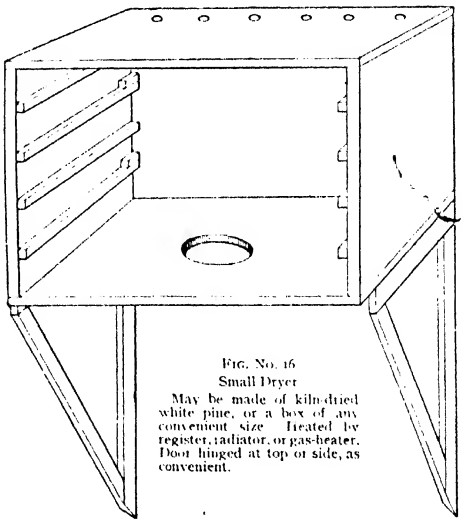


FIG. No. 16
Small Dryer
May be made of kiln-dried white pine, or a box of any convenient size. Heated by register, radiator, or gas-heater. Door hinged at top or side, as convenient.

any desired size, from a small box hung over a radiator or small heater, to an indefinite series of room-high steam-heated closets, of sufficient capacity for the largest manufacturer.

A dryer of suitable size for the pharmacist may be made about 30 inches square and of the same height. This will accommodate four trays. It may be constructed of ⅞-inch kiln-dried white pine, spruce, or poplar, or from a well dried packing-case of suitable dimensions. Reference to Figure No. 16 will show its details.

SUBSTANCES REQUIRING NO GRANULATION.

A limited number of chemicals frequently used in compressed form require no treatment other than sifting, and sometimes drying, before being compressed. They are manufactured and sold in a granular or finely crystalline form, and are in proper condition for immediate compression. Such chemicals are

Ammonium Bromide,
Ammonium Chloride,
Ammonium Iodide,
Chloral Hydrate,
Potassium Bicarbonate,
Potassium Bromide,
Potassium Iodide,
Potassium Chlorate,
Potassium Nitrate,

Potassium Permanganate,
Sodium Bromide,
Sodium Chloride,
Sodium Sulphocarbolate (crystal).

A glance at these salts will show that all are freely soluble in water, and that a tablet made from any one of them will likewise be soluble. A number of other chemicals, such as Monobromated Camphor, Salol, Terpin Hydrate, and Thymol, can readily be compressed without previous treatment, but as they are insoluble, such resulting tablets are not only insoluble and hence therapeutically inefficient, but in some cases positively dangerous to the patient. The proper methods of treating such substances will be taken up further on.

Substances requiring granulation comprise the large majority of medicaments entering into compressed tablets; with but few exceptions, all except the chemicals mentioned in the foregoing list. In order to produce compressed tablets which will possess the proper qualities (previously stated), medicaments entering into their composition must be mixed with certain excipients adapted to the needs of the particular substance or combination.

EXCIPIENTS AND THEIR APPLICATIONS.

The term *Excipient*, as applied to tablet- (or pill-) making, refers to any substance, other than the medicament, lubricant, and coloring agent, which enters into the composition of the tablet (or pill). Excipients are conveniently divided into five classes, as follows:

1. Moistening agents.

   Water; Alcohol.

2. Adhesives.

   Cane-sugar; Acacia; Tragacanth; Glucose; Gelatin; White Dextrin; Cherry Gum; Flour.

3. Bases.

   Cane-sugar; Milk-sugar; Ammonium Chloride; Common Salt; Yellow Dextrin.

4. Disintegrator.

   Starch.

5. Absorbents.

   Starch; Milk-sugar; Magnesium Carbonate; Calcined Magnesia; Powdered Liquorice Root.

1. Moistening Agents

Water and alcohol are rarely used except in conjunction with some other excipient,

either in powder or solution. While seldom necessary to use distilled water in compressed-tablet making, care should be exercised to use a clear, sanitary water.[1]

2. Adhesives

Cane-sugar is used in preference to other adhesives whenever practicable, because of its greater solubility. In practise, it is used in two ways: (*a*) as a powder, mixed with the other ingredients, and (*b*) in solution as syrup of various strengths. Whichever way used, allowance must be made for the amount of sugar used, when making up the working formula. Cane-sugar should be used to the exclusion of other adhesives (except glucose) in preparing tablets intended for making solutions.

Acacia, in powder, is used to augment the adhesiveness of Mucilage of Acacia, in cases where the amount of mucilage which can be used is not sufficient for the purpose. It

[1] A convenient method of clarifying and decolorizing water is: Dissolve in any convenient quantity of the water three grains of alum to each gallon; allow to stand, covered, for twelve hours or over night; then decant or syphon off the clear water. This procedure removes practically all organic matter.

should be remembered that adhesives *in solution* are more effective than the same amount used in *powder* form subsequently moistened; hence a solution is always to be preferred. Acacia is best used in 10 per cent. and 20 per cent. mucilage. Stronger than this, it is apt to form pasty masses which are difficult to dry.

Acacia should always be accompanied by starch (which see), except in lozenges. Failure in this particular results in tablets which are insoluble or which do not disintegrate. Acacia, as other gums, should be used in the smallest quantity necessary to produce the required adhesion; the amounts vary from 2 per cent. to 10 per cent. of the weight of the total granulation.

Tragacanth is used chiefly in lozenges. It is also useful in granulating such substances as charcoal and other powdered drugs which produce soft granules when other adhesives are used. On account of its great adhesive power, it should be used only where a sufficiently firm granulation is unattainable by other means.

Glucose finds occasional application in granulating mixtures which are intended for

making solutions when a greater adhesive power is required than that possessed by cane-sugar. It is used in the form of a moderately heavy syrup, made by diluting the commercial article with water.

Gelatin has been found by the author to be especially serviceable in granulating Sodium Salicylate. It is softened in cold water, and then warmed to a mucilage (glue), and, of course, used in conjunction with starch. Fifteen per cent. of the weight of the salt is used.

White Dextrin, Cherry Gum, and Flour are used in a manner similar to acacia. They are rather less adhesive.

3. Bases

Substances used for the purpose of increasing the weight of a granulation, in order to produce tablets of a certain weight, are termed *Bases*. Thus, for example, in the case of triturate tablets of Calomel, 1/4 grain, the weight of the finished tablet is made 1 1/2 grains; the excipients used to increase the weight from 1/4 to 1 1/2 grains constitute the *base* of the tablet.

Cane-sugar is largely used for this pur-

pose. It is, however, open to serious objection when used alone, because of its tendency to produce "capping" of the tablets.

Milk-sugar, mixed with an equal weight of cane-sugar, forms an ideal base, which, modified to suit certain cases, is admirably adapted to use in triturate tablets. Alone, milk-sugar is useful as a base for substances possessing a more or less adhesive quality, or for hygroscopic chemicals. In such cases it tends to correct these properties, which are *faults* in granulations.

Ammonium Chloride and *Common Salt* (high-grade) are particularly serviceable as bases for tablets of corrosive sublimate and of potassium arsenite. Corrosive sublimate reacts with organic bases, such as the sugars, and is reduced, causing discoloration of the tablets. No reaction occurs with the bases suggested, while they are of additional value in increasing the solubility of the corrosive sublimate. Potassium arsenite is reduced to metallic arsenic in contact with sugars, in the presence of moisture. Hence such tablets are of dark color. No change occurs with the salts named.

These two bases are used in this capacity

in the form of a fine granule. The medicaments used with them are usually in small proportion and should be dissolved in a little water or alcohol, and mixed with a small portion of the base, before adding to the bulk of the latter.

Yellow Dextrin is used in conjunction with starch in the treatment of Extracts. While rather adhesive it dries out readily (with starch), producing a firm, hard mass, which may easily be reduced to granular condition.

4. Disintegrator

Starch is the one substance used to produce disintegration of tablets. Its power is due to the property of starch grains to absorb water (becoming hydrated). In doing this the grains swell with great force, overcoming the adhesiveness of other ingredients in a tablet, and causing the latter to fall to powder. The value of starch in tablet-making can be readily appreciated by comparing the action of two tablets of bismuth subnitrate, granulated one with acacia mucilage alone, and one with acacia mucilage and *starch*. The former is more than likely to remain a handsome tablet for twenty-four

hours after immersion in water, while the other, if properly made, will fall to powder immediately upon immersion.

Of the various varieties of starch, there is little choice. Potato-starch and corn-starch are perhaps the least expensive, and if white and free from impurities are suited to the purpose.

Many tablet-makers use starch, but few use it in sufficient quantity; fewer still use it except with an excessive quantity of an adhesive, thus counteracting the disintegrating power of the starch.

The amount of starch necessary to produce disintegration is about fifteen per cent. of the weight of the finished tablet. Twenty per cent. is better, and when the size of the tablet will permit, the latter amount should be used.

Starch should not be used in connection with freely soluble medicaments, especially where these constitute the bulk of the tablet formula. Except as an absorbent (which see) it is used exclusively to cause disintegration of insoluble or very slightly soluble medicaments.

It is introduced in three ways: first, as a powder, mixed with the other ingredients; second, as starch-paste, either plain, or with

sugar, acacia or other gum, in solution with it; third, as a powder added to the otherwise finished granulation, just before compressing. In many cases it may be used to advantage in all three ways in one tablet. The powder is always necessary when starch is indicated, in order to introduce a sufficient quantity to be effective. The paste should be used wherever practicable, and in as large quantities as possible, because the amount of starch introduced in this condition is more effective, weight for weight, than in powder. It can seldom, however, be used in paste form when extracts or hygroscopic substances form any considerable proportion of the granulation.

The following formulas are of service for the introduction of starch. Numbers 2 and 3 are sufficiently adhesive in themselves to render unnecessary in most cases the use of adhesives in powder form.

No. 1. Starch Paste

Starch	1	pound
Cold Water	1½	pints
Boiling Water	4	pints
To make	6	pints

Mix the cold water with the starch until perfectly smooth; then pour into the boiling water and stir until translucent.

Or, instead of pouring the mixture into the boiling water, add to the former four pints of cold water and bring to a boil with constant stirring.

No. 2. Sugar-starch Paste

Starch	1	pound
Cane sugar*	$1\frac{1}{2}$	pounds
Cold Water	$4\frac{3}{4}$	pints
To make	6	pints

Mix $1\frac{1}{2}$ pints of the cold water with the starch until perfectly smooth; dissolve the sugar in the remainder of the cold water; then mix all together, and bring to a boil with constant stirring.

No. 3. Gum-starch Paste

Starch	1	pound
Acacia, Dextrin (white), Flour, or Cherry Gum, in powder	$1\frac{1}{2}$	pounds
Cold Water	$4\frac{1}{4}$	pints
To make	6	pints

Mix the starch and gum; then mix with the cold water until perfectly smooth and bring to a boil with constant stirring.

These pastes are subject to decomposition upon long standing and should be freshly

* Two pounds of Glucose may be substituted for the Cane-sugar in this formula, and the whole made to measure six pints.

prepared when required for use. The addition of two drams of Formaldehyde, 40 per cent. solution, is an efficient preservative, and is unobjectionable because of its volatility.

The third method of introducing starch, by mixing it, in powder, with the otherwise finished granulation, is of service in causing the tablet to *partially* disintegrate very rapidly; that is, the *granules* of a compressed tablet so treated separate from each other when the tablet is immersed, but the granules retain their form unless starch in proper proportion is a component part of the granules themselves. Thus, by carefully watching a tablet disintegrate in water, it is often possible to determine whether or not starch has been introduced only by addition to the granulation, and so, whether or not the tablet can be depended upon for quick medication. If the granules themselves remain intact, they are obviously wrongly made, and of scarcely more medicinal activity than a tablet which fails entirely to disintegrate.

5. Absorbents

This class of bodies comprises those substances which have the power to absorb

moisture from other ingredients of tablets. They hasten drying of granulations and partly counteract hygroscopic tendencies of ingredients of that nature.

Starch is largely used for this purpose, especially with extracts. In many cases it thus acts in a double capacity as disintegrator and absorbent.

Milk-sugar is useful in cases in which an extract is in small proportion and thus effects but little solution of the absorbent. When a tincture or fluid extract in small quantity constitutes the medicinal part of a tablet, milk-sugar is an admirable absorbent. If the fluid possesses sufficient adhesiveness, the balance of the tablet may be made up with milk-sugar, in the double rôle of absorbent and base.

Magnesium Carbonate, in fine powder, is an excellent absorbent for oily ingredients, extracts of an oily nature, and other such bodies. It should not be used indiscriminately, because of its antacid properties.

Calcined Magnesia is an even better absorbent for oils than magnesium carbonate, but on account of its strongly alkaline properties must be used with discretion.

Liquorice Root, in fine powder, is sometimes employed in dark-colored tablets as an absorbent, though it has little to recommend it which is not well represented in one or another of those already considered.

TREATMENT OF VARIOUS CLASSES OF MEDICAMENTS

1. Chemicals

(a) *Crystalline, soluble.*

Grind to number 16 or 20 granules, avoiding fine powder by frequent sifting. Dry thoroughly by low heat. If sticking to die or punches occur, lubricate with boric acid if permissible and effective; otherwise reduce to fine powder and granulate, using syrup and water, equal volumes.

(b) *Crystalline, insoluble.*

Reduce to fine powder and treat as under (d).

(c) *Not Crystalline, soluble.*

Usually hygroscopic, of a character similar to sodium salicylate. Not readily considered as a class; taken up individually further on.

(d) *Not Crystalline, insoluble.*

Mix with starch, 15 per cent. Granulate with syrup-starch-paste, or gum-starch-paste, as necessary.

2. Drugs (vegetable)

should be in very fine powder (No. 80 or 100). Usually require strong adhesives, such as gelatin or tragacanth, 5 per cent. to 10 per cent. Also admixture with sugar or milk-sugar to give body to granulation.

3. Pharmaceutical Preparations

(a) *Tinctures, Fluid Extracts, and Wines.*

Deprive of alcohol by distillation or evaporation, reduce on water- or steam-bath to consistence of syrup or a solid extract as occasion requires, and treat as under (b). When a tincture is specified in a tablet formula and the menstruum is the same as that properly used for a fluid extract or solid extract of the same drug, it is entirely proper in every way to use instead of the tincture an equivalent quantity of either the fluid or solid extract; provided always that the latter fully represent the drug.

As *glycerin* can not be used in tablets (except in special cases, referred to later) on account of its non-drying properties, preparations such as tinctures, etc., must be especially prepared without glycerin whenever the usual preparation contains that substance. Failure to observe this precaution will almost invariably result in loss.

(b) *Solid Extracts*

usually lose from 20 to 30 per cent. of their weight in drying out. Average, about 25 per cent. When the weight of the extract constitutes over 10 per cent. of the weight of the finished tablet, the loss in drying should be made up with starch. In small proportion (10 per cent. or less), extracts are best thinned on a water-bath with sufficient alcohol, or alcohol and water, to use the mixture as a moistening agent for the other ingredients of the tablet. Sufficient thinning and a thorough mixing with the powders will insure an even color, and prevent unsightly specks appearing in the finished tablet. Milk-sugar is an excellent base.

When a solid extract constitutes a large proportion of the weight of a tablet, starch

should be added to the extent of 15 or 20 per cent. of the total weight. In case of oily extracts (e. g. saw palmetto), magnesium carbonate (or calcined magnesia) is of service as an absorbent. About 5 per cent. of the weight of the extract usually suffices. Fifteen to twenty per cent. of yellow dextrin assists in making a firm granule without undue hardness or insolubility. Cane-sugar should be avoided, on account of its tendency to dissolve in any moisture attracted by the hygroscopic extracts. The manipulation of the extract is best carried out on a steam-bath. It should be evaporated until a small portion rolled into the form of a pencil and allowed to cool in dry air is perfectly brittle. The powders, previously warmed, should then be stirred into the still soft extract. The mass may then be placed directly upon an iron tray and set in a *dry* place to cool. When thoroughly cold, on tapping the bottom of the inverted tray the mass will fall away in fragments. It is then ready to go through a grinding mill to a number 16 or 20 granule, and is ready for lubrication and compression. In humid weather it is almost impossible to produce a brittle extract in this manner with-

out using undue heat, except by means of a vacuum apparatus. In the absence of this, the extracts should be reduced as far as possible, the powders stirred in, and the mass allowed to become cool enough to allow handling. It is then pulled apart into small pieces by hand, placed on iron trays previously dusted lightly with powdered talc or starch, and put in a warm drying-closet. Several days are usually required for drying a mass of this character. To hasten it, the pieces should be broken smaller from day to day, returning them to the dryer, until finally they are perfectly brittle and can be ground. Exposure to moist air should be carefully avoided.

On a large scale the same object may be accomplished by means of a heavily-geared, steam-jacketed mixer, or by a vacuum-pan.

(c) *Powdered Extracts* are treated as any other hygroscopic powder, by mixing with sugar of milk if in small proportion; and with starch and sugar of milk if in large proportion. The moistening agent should be alcohol, or alcohol and water, as directed under Solid Extracts above (b).

(d) *Resins, Resinoids, etc.*

These are treated as powdered extracts (c).

(e) *Syrups, Elixirs, etc.*

In these preparations, sometimes called for, their equivalent in extract, fluid extract, or chemical is used, and the ingredient treated accordingly. The sugar contained in them is usually disregarded.

4. Volatile Substances

(a) *Oils and liquids of an oily nature.*

These are usually best added to the otherwise finished granulation either by pouring on in a thin stream, or by spraying from an atomizer and lightly mixing by hand. Under no circumstances should they be mixed with the other ingredients and subjected to drying. When an oil is intended as a flavoring agent only, and an exact quantity is not necessary, it is frequently most convenient to spray it on the compressed tablets, previously spread out. After being sprayed, the tablets should be placed at once in a tight container, where, after a few hours, the oil will be evenly diffused. Certain oils (e. g. santal) act as lubricants. When such an oil is required in a smaller quantity than

is necessary to thoroughly lubricate the granulation for compression, it is well to mix the oil with a sufficient quantity of the lubricating oil before applying to the granulation. (Lubrication is considered as a separate subject further on.)

Another distinct method of applying oils is that of immersion of the tablets in the oil. This is the only practicable method when large quantities enter into the tablet. From two to five minims of oils or substances such as creosote or guaiacol are occasionally demanded. It is impossible, by present methods, to put into a tablet of suitable size for swallowing, over three minims of oil. When the amount specified is more than that quantity, but two escapes for the manufacturer remain. He may divide the dose between two or more tablets, or he may resort to the immersion method, saturating the tablets, and stating on the label the quantity contained. The immersion is best performed by placing the tablets in a funnel or percolator, and pouring on a measured quantity of the oil. Return to the tablets a second or third time any oil which passes through, then allow to drain for several hours. Measure the oil

which drains off and so determine the amount absorbed. Divide this by the number of tablets to ascertain the quantity in each tablet. It would doubtless be a surprise to many to note that a tablet thus prepared and actually containing, say, two minims of creosote will have a very much more pronounced odor than many tablets of the market purporting to contain a larger quantity. The conclusion is obvious.

Still another method, but a slower one, is of service in supplying doses of from one-quarter to two minims, by means of a medicine-dropper. The tablets in this case are spread out in a layer and one or two drops, as occasion requires, are allowed to fall onto each tablet. If a definite dose of a fraction of a minim—say one quarter—is required, the oil is mixed with sufficient inert oil (usually white petroleum oil) so that one *drop* of the mixture will contain the exact dose. For accurate work it is necessary to know the measure of a drop delivered from the dropper used. In order to determine this the medicinal oil should be mixed with a certain amount of the petroleum oil, known

to be less than the amount required.[1] Then drop from the dropper a counted number of drops into a minim graduate, and from the measure determine the volume to which the mixture must be made up so that each drop will contain the required dose. For example, for 1,000 tablets of creosote, 1/4 minim, mix 250 minims of creosote with 250 minims of petroleum oil. Of this drop 100 drops into a minim graduate. Assuming that it measured 60 minims, then for 1,000 drops (one for each tablet) 600 minims would be required. Mix all together again and add sufficient petroleum oil to make 600 minims. Mix, and drop one drop on each tablet.

Tablets whose formulas call for oily substances only, or but a small proportion of other medicaments, are best made of a mixture of equal parts of cane- and milk-sugars, granulated with water. The amount of oil to be incorporated determines the weight of tablet as well as the method of incorporating. It is useless to attempt to compress a granu-

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[1] It should be remembered that a medicine-dropper usually delivers a drop measuring much less than a minim, and it is well to figure roughly for this test about one-half minim.

lation containing more than about 5 per cent. of oil. Above this quantity recourse must be had to one or the other of the three methods, spraying, immersing, or dropping.

(b) *Volatile Solids*, such as camphor, menthol, thymol, etc., are considered further on, under their respective headings.

5. Effervescent Tablets

Three methods are possible in the preparation of this class of tablets. Strange to say, the poorest method is usually adopted, probably because it is more easily performed than the second method, while the third has not been hitherto published, and is not, the author believes, generally known.

As a type of effervescent tablets, Lithium Citrate, 5 grain, is a good example. By whichever method made, the following quantities may be used:

Lithium Carbonate	2 lb.	8 oz.
Citric Acid, powdered	4 lb.	11 oz.
Sodium Bicarbonate, powdered	4 lb.	4 oz.
Tartaric Acid, powdered	3 lb.	7 oz.

To make 7,000 tablets weighing 14 grains each.

First method.

Mix the lithia and soda, granulating with a mixture of syrup, three volumes, and water, one volume. Mix the acids, granulating likewise. Dry each granulation separately, sift (No. 12 to 16), mix, lubricate, and compress warm. It is practically impossible to compress this granulation without lubricating with oil. The resulting solution of tablets made by this method is therefore milky in proportion to the amount of oil used. Under exceptionally favorable weather conditions, they may be lubricated with powdered boric acid (a half-ounce to the pound) and compress fairly well. Tablets made by this method are slower in effervescing than by either of the following, and in this lies their chief claim to consideration, because they are somewhat more readily preserved from deterioration.

Second method.

This method is the one in most common use by large manufacturers for the preparation of both effervescent tablets and salts.

Mix all the ingredients together in fine powder, and heat on a steam-bath, in a porcelain (or porcelain-lined) dish or kettle, stir-

ring constantly until the water of crystallization of the citric acid causes granulation. Continue the heating with frequent stirring until perfectly dry. It is important that the citric acid used contain its full amount of water of crystallization. Lubricating and compressing requirements of this method are similar to those of the first (above). A serious objection to this method lies in the waste incurred during the heating. A portion, usually from five to ten per cent., adheres to the dish and, overheated, becomes discolored and unfit for use. On a small scale this granulation may be produced on a water-bath, by previously spraying the mixed powders with a little water, and thoroughly mixing. Water-bath heat is not sufficient to produce granulation with the water of crystallization alone, and, especially in dry weather, simply produces evaporation; hence the addition of the water.

Third method (author's method).

This method was devised by the author some years ago, after long experimenting to overcome the use of oil as a lubricant in effervescent tablets. It was found that the

lithium carbonate and tartaric acid caused most of the sticking to die and punches, while the soda and citric acid, even in combination, gave little trouble. Hence, it was surmised that by making a granulation of the first-named ingredients, and coating those granules with the soda and citric acid, an easily compressing granulation could be made. Continued use of the method, both in a small and large way, has thoroughly demonstrated the correctness of the conclusion.

Mix the lithium carbonate with the tartaric acid. Moisten quickly and uniformly with 20 fluid ounces of syrup (U. S. P. strength). This is best accomplished in a cylinder mixer (See Figure No. 9). Spread at once on trays and place in a dryer at a temperature of about 135° Fahrenheit. In a few minutes a mass will form. Remove from the dryer, and as soon as partly cool force through a number four sieve. Return to the dryer at a lower temperature (not over 120° Fahrenheit), and thoroughly dry. Grind and sift through a number 12 to 16 sieve. Place the dry granulation, together with the soda and citric acid, in the mixer and moisten with a mixture of syrup, 3fl. oz., and water,

1 fl. oz. Treat exactly as in the case of the previous mixture, reducing to a number 12 to 16 granule, and avoiding the production of fine powder. As fast as sifted return to the dryer, or place in air-tight, dry containers until ready for compressing. Immediately before compressing, warm, and add one-half ounce powdered boric acid to each pound of granulation. Effervescent tablets made by this method will compress with less trouble than by either of the other methods, provided the granulation be prepared in strict accordance with the directions. Beside producing a tablet which yields a perfectly bright solution in water, it effervesces with great rapidity, and may be compressed in any except the most humid atmosphere.

Effervescent tablets are perhaps the most difficult of any to prepare, and, until other classes of tablets are mastered, the beginner can scarcely expect to meet with marked success in their manufacture. Extreme care in regard to cleanliness, as well as absence from moisture, must be observed. In compressing, the die and punches should occasionally be cleaned and oiled, and the excess of oil wiped off with a soft cloth.

CHAPTER V

LUBRICATING

But few granulations can be readily compressed without the addition of some substance to prevent their adherence to the punches and die. Substances used for this purpose are termed Lubricants. Water-white petroleum oil, purified powdered talcum, and powdered boric acid are chiefly used.

When a granulation adheres to the inner surface of the die, it is said to "*stick;*" when it adheres to the face of a punch, to "*pick.*"

Oil particularly prevents *sticking*, while *talcum* and *boric acid* overcome *picking*. This distinction should be borne in mind, for while these substances each have some effect on both sticking and picking, they accomplish the purpose in smaller quantities if used to correct the fault over which they have more control.

The characteristics of the various granulations can be learned only by experience. Some require no lubrication whatever, but

these are chiefly the granular salts mentioned in Chapter IV. A few require small quantities of one or two lubricants, while others require generous amounts.

Oil is preferable to talcum or boric acid in the lubrication of colored tablets (e. g., those containing extracts, charcoal, etc.) as the latter modify the colors and give a dull appearance to the tablets. Charcoal tablets lubricated with talcum are gray, while those lubricated with oil only, are black. Oil, on the other hand, brightens the lighter colors, but it should in all cases be used as sparingly as possible, and especially in tablets composed of entirely soluble ingredients; for it tends to retard solution and, further, renders the solution milky. In spite of its objectionable feature, oil is, for lack of a better substance, largely and necessarily used, both alone and in conjunction with talcum; for the majority of granulations tend both to stick and to pick.

In small lots, oil is best added by means of an atomizer to the granulation previously spread out in a thin layer. In larger lots it is conveniently shaken from a sprinkle-top bottle, while in large quantities of granula-

tions the oil is poured on in a thin stream. In all cases the oiled granulation should be gently but thoroughly mixed by hand and put through a coarse sieve.

The usual requirement is about 50 to 60 minims of oil to one pound of granulation, but the minimum quantity which can be used for a particular lot can be learned only by experiment.

Solution of oil or vaseline in ether has been recommended as a means of distributing the oil evenly throughout the granulation. The objections to this procedure are that the ethereal solution penetrates the granule rapidly, depositing a large part of the oil where it is useless, and, further, is expensive.

Whenever oil is to be used with talcum, the oil should be applied first. If added after the talcum, it is largely absorbed by the fine powder, and the effectiveness of both lubricants is partly lost.

Talcum, or *French Chalk*, powdered and purified, is the most useful lubricant for the prevention of picking. Though sometimes used alone, it is generally used in conjunction with oil. About two per cent. of the weight of the granulation is usually required,

though in some cases (*e. g.* Quinine Sulphate) as much as five per cent. is necessary. Allowance for such an amount should be made, either in the weight of excipients used, or in adjusting the weight of the tablets when compressing. Under ordinary conditions no allowance in weight is made for lubricants. Talcum is added by sifting[1] the required amount over the surface of the well-spread-out granulation, and mixing the whole lightly by hand.

Boric Acid, powdered, is the only permissible lubricant for tablets intended for making clear solutions (*e. g.* Effervescent Tablets; Alum Comp.). Five per cent. of the weight of the granulation is usually required, and sometimes more. Allowance must, of course, be made for the amount used. When Boric Acid is a medicament (*e. g.* Vaginal Astringent, Leucorrhœa), the proper amount for lubrication should be omitted from the granulation, and subsequently added as the lubricant.

[1] Through about a number 40 sieve.

CHAPTER VI.

COMPRESSING

The compressing-machines of the market operate on similar principles, and differ from each other chiefly in details. Hand-machines are in some cases identical with the corresponding power-machines except that a handle on the fly-wheel replaces a pair of pulleys and their support. Other hand-machines are built on the same general plan as those for power, but are made lighter throughout. Hand-machines are materially less expensive than power-machines, but the choice between them obviously must lie with the purchaser.

While in the arrangement of driving mechanism the various machines differ, they all possess the following more or less similar parts: a hopper or funnel, into which the granulation is put; a feeding-shoe that automatically fills the die, and pushes aside the finished tablets; a device for holding the die in position; a lower plunger, for holding and operating the lower punch, provided with an

adjustment for regulating the weight of the tablets; and an upper plunger, for holding and operating the upper punch, provided with an adjustment for regulating the hardness of the tablets.

The machines now on the market are the outcome of long experimenting to overcome serious defects of the earlier ones. Knuckle-joints and gears have mostly been replaced by eccentric cams, and revolving, by stationary die-plates. Springs of the older machines have given way to mechanisms of positive action, and various other advances have been made, all with a view to simplicity

FIG. No. 17
Hand-Punches and Die

of construction, ease and precision of operation, minimum wear, maximum strength and durability, rapidity of action, and perfection of product.

The simplest form of compressing apparatus is illustrated in Figure No. 17. It is useful in prescription work for making

a very limited number of tablets. It is operated by inserting the lower punch into the die, placing in the latter a weighed quan-

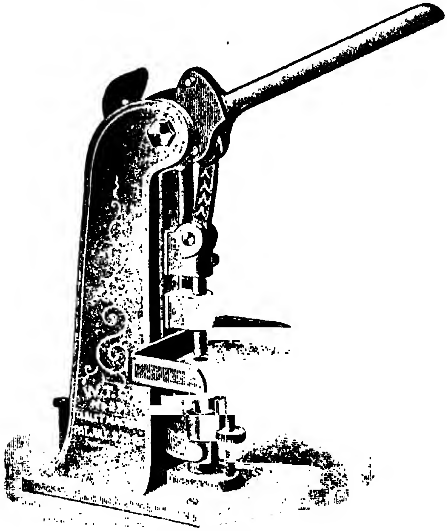
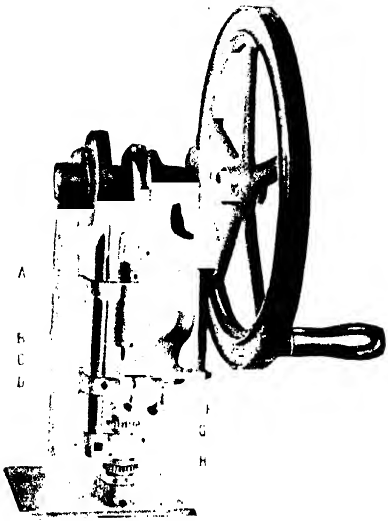


Fig. No. 18
"No. 25" Machine, Whitall, Tatum Co.

tity of the granulation, inserting the upper punch, and striking the latter a quick, sharp, blow with a mallet.

Next in simplicity is the "No. 25" Machine, sold by Whitall, Tatum Co. (See Figure No. 18.)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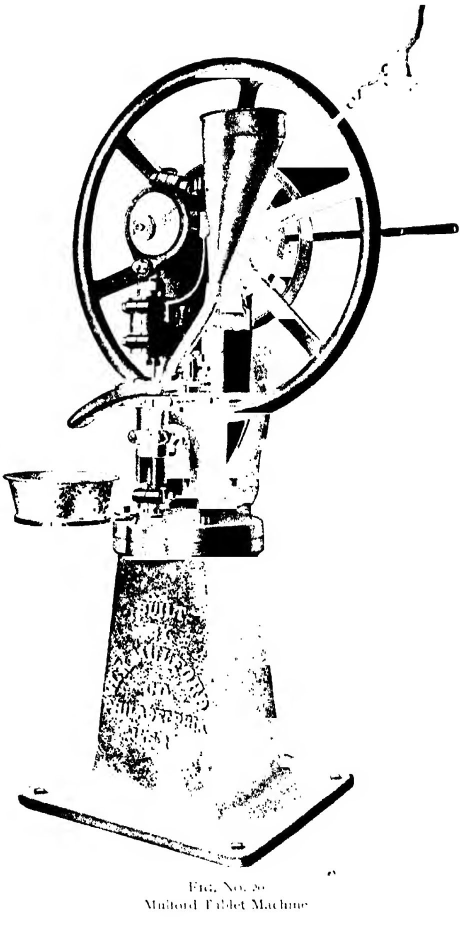


Fig. No. 30
Mulford Tablet Machine

The "Eureka" Hand Machine (F. J. Stokes Machine Co.) is a good type of entirely automatic compressing-machine, and is reasonable in price. It is adapted to the needs of the retail pharmacist for making a general line of tablets in small quantities. (See Figure No. 19.)

The Mulford Tablet Machine (Figure No. 20) is furnished for hand or for power, and in either case is adapted to the manufacture of all sizes and kinds of compressed tablets in general use.

The Stokes Tablet Machine, for power (Figure No. 21), is one of the newer ma-
s of the market and gives good results.
iief points of excellence are its direct
n and simplicity of adjustments.
iltiple Punch Machines have been pro-
l from time to time, but only recently
they been made to give satisfaction.
djustment and alignment of more than
et of punches and die on a machine has
a difficult problem to solve. They are
reat service as time-savers to manu-
ers producing large quantities of single
ilas of tablets, and in such cases the
multiple machines will compress from

150 to 400 tablets per minute, depending upon the size of tablet. (See Fig. No. 22.)

SETTING UP TABLET-MACHINES.

A machine should be placed so that the operator may have ready access to its four sides. If other than a light hand-machine, it should be fastened, perfectly level, through the floor, to the joists, by means of heavy lag-screws or bolts. The shaft to which it is belted should be at least six feet, preferably about eight, from the main shaft of the machine. As different makes of machines are intended to run at different speeds, and possess different speed-limits, the latter should be ascertained (from the maker or by trial) before belting the machine. The best results are obtained by operating the machine at about three-fourths the speed-limit. Thus a machine whose speed-limit is 120 tablets per minute should be belted to run about 90 to 100. This will not only insure a better product, but greatly prolong the life of a machine otherwise rightly used. The size of the pulley to which the machine is to be belted is readily calculated from the diameter of the machine-pulleys, the required

FIG. No. 22
Stokes' Multiple Tablet Machine

number of revolutions per minute, and the number of revolutions of the shaft per minute.

As explicit directions for operating machines are supplied by the makers, they would be superfluous here. A few points, however, which are frequent sources of annoyance, will be given:

The top of the die must be exactly flush all around with the table of the machine.

The lower punch must rest snugly upon the bottom of its socket, and the face of the punch must be exactly flush with the top of the die, when the punch is at its highest point. If too high, it will injure the feeding-shoe. If too low, the tablets will be nicked or broken when ejected.

In adjusting the weight of a tablet, the lower punch should be at or near its lowest point.

When locking the upper punch in place, it should project a short distance into the die, in order to insure perfect alignment and thus prevent injury to punch or die.

All bearings of the machine should be kept well oiled. The heavier parts are best lubricated with high-grade cylinder oil, or a mixt-

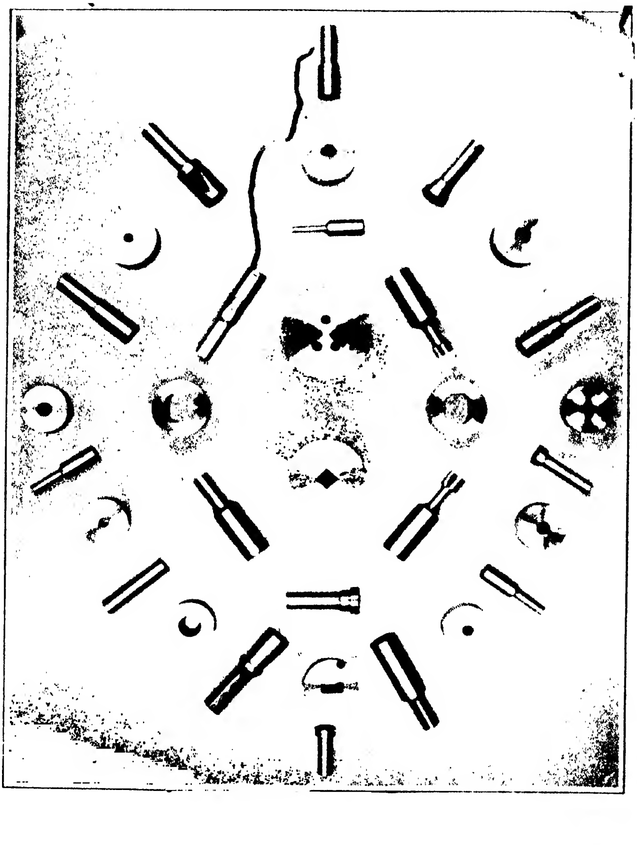
ture of equal parts of vaseline and light petroleum oil; for the lighter parts, sperm oil or light petroleum oil are satisfactory. Excess of oil should be avoided: it is apt to spatter the tablets as they leave the machine.

All parts of the machine should be kept scrupulously clean. Parts in which dirt accumulates, which can be readily removed, should occasionally be taken out and thoroughly cleaned. Live steam is very effective for this purpose; benzine or alcohol usually answers.

When a machine is located in a room in which mixing, granulating, or other dusty processes are conducted, it should be covered, when not in use, with some protective material such as Canton flannel or rubber cloth.

PUNCHES AND DIES.

When not in use, punches and dies should be completely smeared over with vaseline (light oil will not answer) and wrapped in paper, as a protection from rust. In this condition they are conveniently kept in a small cabinet with marked divisions (indicating their size), such as a proprietary-pill cabinet, or similar suitable container. A soft



cloth will sufficiently remove the grease when required for use. Some manufacturers keep punches and dies *immersed* in kerosene or light petroleum oil, which accomplishes the desired result. Rust may be removed from punches or dies, and also the surfaces may be well polished, by means of fine emery cloth or finely powdered emery (emery flour) moistened with oil.

In putting the die and punches into a machine, first put in the lower punch, next the die, and lastly the upper punch. In removing, take out the upper punch first; the lower punch and die will usually come out together, and in the absence of the upper punch, the latter will be saved many injuries which would be otherwise caused by the sudden exit of the lower punch and die.

Occasional annoyance is given by the punches entering the sockets of the plungers with great difficulty. It is usually caused by a dirty condition of the socket, though sometimes by a too snugly fitting punch. In the former case cleaning the socket is the remedy; in the latter both punches should be well vaselined, inserted as far as possible into their respective sockets, and a piece of

thick leather or several thicknesses of card-board laid on the face of the lower punch; the fly-wheel is then slowly revolved until the punches are forced into position. If difficulty is encountered in removing the punches that have been well oiled before insertion, they may generally be removed by wrapping the projecting ends with moderately fine emery-cloth, and applying pincers or gas-pliers; care must be taken to avoid contact with the face-edges. In case a lower punch sticks hard in the die after removal from the machine, immersion in hot water or steam, long enough to expand the die, will allow the easy exit of the punch.

No instrument of metal should be used to clean the faces of punches or dies. A soft cloth, moistened, will accomplish the result without injury.

Dies are unfit for use, until rebored to a larger size, when they become so worn as to show a depression at the point where tablets are formed. Tablets compressed in dies so worn have, on the instant of compression, a larger diameter than the exit of the die through which they subsequently pass. This is a frequent cause of "capping," the term

applied to the splitting off of the upper face of a tablet. Some machines are constructed for the use of reversible dies; i. e. dies which are exactly alike top and bottom. When such a die becomes worn at one end, its reversal will remedy the capping, if caused by wear.

Upper punches which have become rounded on the edges produce ridges upon the upper edges of the tablets, and sometimes occasion capping. Such punches are unfit for use until refaced.

Lower punches are not apt to be injured except by gross carelessness. The most frequent injury given them by beginners is caused by allowing the upper and lower punches to jamb together.

The repair of punches and dies necessitates the use of a good machine lathe and a flexible shaft to which small emery-wheels are attached. It requires specially trained machinist's work, such as is not usually obtainable in ordinary machine-shops. It is advisable, therefore, except for large establishments, to have such repairing done by those thoroughly equipped for and experienced in the work; preferably the makers of the tablet-machines.

Punches, and dies to fit, may be had in almost any desired shape: Designs or letters may be sunk upon the punch-faces, but occasion more or less trouble by picking. Flat-faced punches are in common use for compressing triturate tablets in imitation of the moulded variety, though, of course, none but the veriest tyro is deceived thereby. Concave faces are the usual form. For tablets which are to be subsequently coated, they should be ground *extra* concave.

CHOICE OF SIZE OF PUNCHES AND DIES

Punches and dies are usually made in sizes beginning with a diameter of 1–8 inch and increasing by 1–32 inch up to 3–4 inch. For ordinary work, however, the following sizes are sufficient:—7–32, 1–4, 5–16, 11–32, 3–8, 13–32, 7–16, 1–2, 9–16, and 5–8 inch.

With very few exceptions[1] these sizes will answer for a complete line of compressed triturates, tablets, and lozenges, as listed by manufacturers. Pharmacists desiring simply to compress certain tablets most frequently called for, and to confine themselves for the time

[1] The chief exceptions are Potassium Iodide, 1 grain, and Potassium Permanganate, 1 grain, which require a 3-16 or 5-32 inch die

being to the three sets of punches and dies usually supplied with hand-machines, will find the 7–32, 5–16, and 3–8 inch the most serviceable assortment. The necessities of the case will, of course, indicate other sizes, as occasion arises. The size of die to be selected for a certain tablet is dependent upon (1) the weight of the tablet, (2) the specific gravity of the mixture, (3) the use for which the tablet is intended, and (4) custom.

Tablets intended for solution in water or on the tongue should be made thinner (and consequently in a larger die) than those intended to be swallowed entire. The same applies to tablets which are to be coated. The shape generally adopted as a standard for tablets intended for solution or coating is that of Potassium Chlorate, 5 grain, compressed hard in an 11–32 inch die. The size of die to be used for other tablets (for solution or coating) is dependent upon the weight and specific gravity. It should not be inferred by this that it is necessary to know exactly or to determine the specific gravity of tablet granulations. The statement is one of the principle which governs the choice. Thus, it is evident that five grains of granular ammonium chloride

require a larger die to form a tablet of the same shape and hardness than five grains of potassium iodide. The former is the much lighter salt (lower specific gravity). A few trials, or an examination of reliable tablets of the market, will readily indicate the size required, should the beginner find himself at a loss.

The rank and file of tablets are compressed somewhat thicker in proportion to the diameter than tablets for solution or coating. A good example of the proper shape is seen in most 1¼ grain triturate tablets compressed in a 7–32 inch die, or "Diuretic" tablets in an 11–32 inch die. These proportions are best adhered to as closely as possible for the sake of uniformity in appearance.

Two conspicuous exceptions to this shape are *customary*. Soda Mint and Migraine No. 1 tablets are usually, though not always, compressed in a 5–16 inch die, and are thus decidedly thicker than most other tablets of the same diameter.

REGULATION OF WEIGHT

For this purpose an ordinary prescription balance is sufficiently accurate. In adjusting the weight of small tablets, such as tritu-

rates, etc., a sufficient number to weigh at least ten grains should be placed in the scale-pan. Thus, if a single tablet is to weigh 1 1/4 grains, eight tablets should be used to regulate the weight, or, better, sixteen tablets, weighing twenty grains. The larger the weight, the smaller the error, or variation from the exact weight. As the machine runs, the weight should be tested, from time to time, in order to guard against change in weight of tablets.

Variation in weight may be caused by

1. Machine adjustments becoming loosened or unlocked.

2. Wearing of the machine cams (only after misuse or long use), which is provided for in some makes by special adjustments.

3. Too high speed of machine.

4. Imperfect feeding, due to faulty granulation: (*a*) insufficiently dry; (*b*) too soft granules; (*c*) too fine granules; (*d*) too coarse granules; (*e*) too much powder.

5. Presence of foreign material in feeding tube or shoe, such as a fragment of paper, wood, etc.[1]

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[1] It sometimes happens that in reversing the fly wheel of a machine, a tablet is accidentally forced up into the feeding-shoe, unnoticed. This, of course, occasions imperfect feeding.

REGULATION OF PRESSURE

Tablets which are intended to be dissolved upon the tongue should be compressed *hard*, in order that the local effect may be prolonged.

All other tablets should be compressed just hard enough to withstand abrasion when subjected to the ordinary handling in sifting, bottling, and dispensing. With practice, the correct hardness of a tablet can be judged by cracking it between the thumb and the first two fingers. When of the right hardness, a tablet will crack *readily* into two parts, neither part crumbling.

CAPPING

This term is applied to the splitting off of the upper face of a tablet. It is sometimes a source of great annoyance, especially in acetanilid and similar tablets. It occasionally happens that tablets which appear to be perfect as they leave the machine become capped after bottling. To guard against this, shake about a dozen tablets together vigorously in the hollow of both hands. If, after ten or fifteen seconds of this treatment, no

capped tablets are found, they may be considered safe from capping.

Capping may be caused by one or more of the following:

1. Imperfect upper punch. This is rarely a cause in itself. If other conditions are right, a worn upper punch seldom or never occasions capping. When the granulation is not far from right and the machine and its parts are in good running order, and capping occurs, the use of a newly polished upper punch will sometimes prove a remedy.

2. Imperfect or worn die. This is a common cause. Reversal or renewal of the die is the obvious remedy.

3. Imperfect alignment of punches or die. This is usually caused by neglect of proper precaution in putting in and locking into the machine. In such cases the upper punch should be unlocked, the fly-wheel turned until the face of the punch projects into the die and locked while in that position. The upper edge of the die must, of course, be exactly flush *all around* with the machine table.

4. Too much pressure. By reducing the pressure very slightly, capping may frequently be overcome. Care must be taken that

the pressure is not reduced too much, and a tablet too soft to withstand handling be produced.

5. Damp granulation. While not often a cause of capping, it sometimes happens that a granulation which has been insufficiently dried, or exposed to damp air, will give rise to capping. The remedy is obvious.

6. Too much fine powder in granulation. This condition may result from forcing a very hard, dry granulation through its sieve, or from the sifting of too soft a granulation. Capping under these circumstances may frequently be remedied by gently sifting out such powder as will easily pass through a number 50 sieve, and compressing the remaining granulation. The fine powder may be regranulated by itself or added to the powder for granulation of a subsequent lot. This powder will of course contain practically all of any talcum added for lubrication, and allowance should be made therefor.

7. Too soft granulation. Occasionally a soft granulation, which retains its comparative freedom from fine powder until fed into the die, will cap; because, as the punch compresses it, powder is thereby formed, and the

same conditions then exist as if excess of powder were present before the granulation entered the die. The only remedy in such a case is proper regranulation, usually with more moistening or adhesive agent.

8. Wrongly proportioned excipients. The last two mentioned causes of capping (6 and 7) may frequently be referred to wrongly proportioned excipients, or even to too little or too much moistening agent. A granulation of moderate hardness, with but a small proportion (not over fifteen per cent.) of fine powder, rarely caps. Other means failing to remedy capping, recourse to regranulation must be had, with a view to so changing the proportions of excipients as to form a granule of the proper degree of hardness. It is impossible to lay down any general rule for such a regranulation. In many cases, however, a soft granulation may be remedied by first reducing to a number fifty or finer powder and granulating with syrup (diluted) or other indicated adhesive, care being taken to preserve the proper proportions of starch or other excipients which the particular case requires. Too hard granulation, again, may often be remedied by powdering and granu-

lating with just enough water to slightly dampen it. If water has too great a solvent action, alcohol or other liquid having a less solvent action on the material should be used.

An effective remedy for capping in tablets of *acetanilid* and similar substances is the spraying of the granulation with a one per cent. solution of glycerin in diluted alcohol. About six ounces is required for ten pounds of granulation. Compress immediately and dry out the finished tablets at low temperature.

PICKING

This term refers to the adherence of a granulation to the face of a punch. Reference was made to it in the chapter on Lubricating. Lubrication, however, except in excess, will not always overcome picking. In such cases other causes than the inherent tendency of a granulation to pick are to be found. Picking may usually be referred to one of the following causes:

1. Damp granulation. Should be carefully dried, and, if found necessary, lubricated a second time.

2. Excess of powder, especially of a non-lubricating nature, such as quinine sulphate, milk sugar, or bismuth salts. Sifting out the excess of powder (number fifty sieve) or regranulation with proper precautions (see under "Capping," 8) are remedies.

3. Too soft granulation. See under "Capping," 7.

4. Scratched face of punch. A new or repaired punch is the obvious remedy.

5. Damp face of punch. The punch should be carefully cleaned with a damp cloth, dried, smeared with a little oil or vaseline, and the excess wiped off.

STICKING

This term refers to the adherence of a granulation to the inner surface of a die, during compression. The causes are similar to those which occasion picking.

In the case of some tablets (*e. g.* Effervescent Lithia) it is necessary occasionally to stop the feeding into the die, place a few drops of oil in the latter, run the punches up and down a few times, and wipe off the excess of oil.

DUST AND SIFTINGS

More or less fine powder sifts through under the feeding-shoe, onto the table of the machine. Also a variable amount of the same material is obtained by shaking the finished tablets on a coarse sieve, before bottling.[1] This dust, if not discolored, should be preserved for subsequent use in either the same kind of tablets or other tablets or preparations requiring those ingredients. Thus, morphine dust may be collected, dissolved, and converted into solution of morphine acetate of definite strength and utilized in Syrup White Pine Compound.

[1] The fine dust adhering to most compressed tablets, which, if allowed to remain, gives an unsightly appearance to the bottled tablets, should be forcibly blown off with a small pair of bellows, such as may usually be purchased of wholesale druggists.

CHAPTER VII

COLORING

ARTIFICIALLY colored tablets are regularly prescribed for a variety of purposes, among which are the following:

To administer tablets of the same formula a patient has been using, without the latter's knowledge.

To render tablets more attractive, especially to children.

To disguise regular and private formulas.

To enable patients and physicians to distinguish at a glance between two kinds of tablets otherwise similar in appearance.

In the popular mind, vegetable colors (and carmin) are, as a rule, preferable to the artificial and mineral, because of the prevalent idea that the latter are poisonous. While with respect to certain of these colors the idea is true, the use of anilin and mineral colors that are shown to have no untoward effect upon the human economy is open to no objection. But few vegetable colors are used for tablets, the most serviceable being curcuma (turmeric), cudbear, caramel, and

charcoal (willow). Carmin has considerable application, and lampblack a limited one. Among mineral colors, burnt umber and burnt sienna play an important rôle in "chocolate" coating, although sometimes a precipitated iron hydroxid, or oxid, is used. For most colors, carefully selected anilin dyes produce the most satisfactory results. It is important, however, that only those be employed which are therapeutically unobjectionable. The drawback to the use of some anilins is the presence of arsenic and other mineral poisons in appreciable quantity; of others, their antidigestive properties. Anilin dyes have received much attention at the hands of physiologists because of their onetime rather indiscriminate use in food-products. As a result of this attention two extensive lists of these colors have been published and adopted by the National Association of Confectioners of the United States. The first list comprises the colors pronounced permissible for use in food-products, and the second, those forbidden. A summary of the lists, reprinted, by permission, from Leffmann and Beam's "Select Methods in Food Analysis" follows:

PERMITTED

Ultramarine Blue.

Ultramarine Violet.

Manganese Brown.

Chocolate Brown and colors of a similar nature have as their basis natural or precipitated ferric oxid which in an impure condition may have small quantities of arsenic in its composition. It is possible with proper care to secure raw material entirely free from this objectionable element, and no ferric oxid containing any traces of arsenic should be used in the preparation of color.

Ultramarine Green.

Cochineal Carmin.

Carthamic Acid (from saffron).

Red Wood.

Artificial Alizarin and Purpurin.

Cherry and Beet Juices.

Eosin—Eosin A, Eosin G extra, Eosin G G F, Eosin J J J, Eosin J J J J extra, Eosin extra, Eosin K S, Eosin D H, Eosin J J F.

Erythrosin—Erythrosin D, Erythrosin B, Pyrosin B, Primrose Soluble, Eosin J, Dianthin B.

Rose Bengale—Rose Bengale N, Rose Bengale A T, Rose Bengale G.

Phloxin—Phloxin T A, Eosin Blue, Cyanosin, Eosin 10 B.

Bordeaux and Ponceau reds resulting from the action of Naphtholsulfonic acids on diazoxylenes.

Ponceau 2 R—Ponceau G, Ponceau G R, Ponceau R, Brilliant Ponceau G, Ponceau J.

Bordeaux B—Fast Red B, Bordeaux B L, Bordeaux G, Bordeaux R extra, Cerasin, Rouge B.

Ponceau G G—Brilliant Ponceau G G, Ponceau J J.

Fuchsin S—Acid Magenta, Rubin S, and Fuchsin.

Archil Substitute—Naphthion red.

Orange I—Orange No. 1, Naphthol orange, α-Naphthol orange, Tropeolin OOO 1.

Congo Red.

Azorubin S—Azorubin, Azorubin A, Azoacidrubin, Fast red C, Carmoisin, Brilliant Carmoisin O.

Fast Red D—Fast red E B, Fast red N S, Amaranth, Azoacidrubin B B, Bordeaux D H, Bordeaux S, Naphthol red S, Naphthol red O, Victoria ruby, Wool red (extra).

Fast Red—Fast red E, Fast red S, Acid Carmoisin S.

Ponceau 4 G B—Crocein Orange, Brilliant Orange G, Orange G R X, Pyrotin Orange, Orange E N L.

Metanitrazotin.

Annatto.

Saffron.

Safflower.

Turmeric.

Naphthol Yellow S—Citronin A, Sulphur yellow S, Anilin yellow S, Anilin yellow, Succinin, Saffron yellow, Solid yellow, Acid yellow S.

Brilliant Yellow (Schoelkopf).

Fast Yellow—Fast yellow G, Fast yellow (greenish), Fast yellow S, Acid yellow, New yellow L.

Fast Yellow R.

Azarin S.

Orange—Orange G T, Orange R N, Brilliant Orange O, Orange N.

Spinach Green.

Chinese Green.

Malachite Green—Malachite green B, Belzaldehyde green, New Victoria green, New green, Solid green crystals, Solid

green O, Diamond green, Diamond green B, Fast green, Bitter Almond-oil green.

Dinitrosoresorsin—Solid green O, in paste, Dark green, Chlorin, Russia green, Alsace green, Fast green, Resorcinol green.

Indigo.

Litmus.

Archil Blue.

Gentian Blue 6 B—Spirit Blue, Spirit Blue F C S, Opal Blue, Hessian Blue, Light Blue.

Coupier's Blue—Fast Blue R and B, Solid Blue R R and B, Indigin D F, Indulin (soluble in alcohol), Indophenin extra, Blue C B (soluble in alcohol), Nigrosin (soluble in alcohol).

In general such blue colors as are derived from Triphenylrosanilin or from Diphenylamin.

Paris Violet—Methyl violet B and B B, Methyl violet V 3, Pyoktanin, Malbery blue.

Wool Black.

Naphthol Black P.

Azoblue.

Mauvein—Rosalan, Violet paste, Chrome violet, Anilin violet, Anilin purple, Perkins

violet, Indisin, Phenamin, Purpurin, Tyralin, Tyrian purple, Lydin.

Caramel.

Licorice.

Chrysamin R.

FORBIDDEN

All colors containing appreciable amounts of mercury, lead, copper, arsenic, antimony, tin, zinc, chromium, cadmium, and barium.

Ponceau 3 R B—Ponceau B extra, Fast Ponceau B, New Red L, Scarlet E C, Imperial Scarlet, Old Scarlet, Biebrich Scarlet.

Crocein Scarlet 3 B—Ponceau 4 R B.

Cochenille Red A—Crocein Scarlet 4 B and G, Brilliant Scarlet, Brilliant Ponceau 4 R, Ponceau 4 R, Ponceau Brilliant 4 R, New Coccin Scarlet.

Crocein Scarlet 7 B—Crocein Scarlet 8 B, Ponceau 6 R B.

Crocein Scarlet O Extra.

Safranin—Safranin T, Safranin extra G, Safranin G extra, G G S S, Safranin G O O O, Safranin F F extra, No. O, Safranin conc., Safranin A G extra, Safranin A G T extra, Anilin pink.

Gum Gutta.

Picric Acid.

Martius Yellow—Naphthylamin yellow, Jaune d'or, Manchester yellow, Naphthalene yellow, Naphthol yellow.

Acme Yellow—Chrysoin, Chryseolin yellow T, Gold yellow, Resorcin yellow, Acid yellow R S, Tropeolin O, Jaune II.

Victoria Yellow—Victoria Orange, Anilin Orange, Dinitrocresol, Saffron Substitute, Golden yellow.

Orange II—Orange II, Orange P, Orange extra, Orange A, Orange G, Acid Orange, Gold Orange, Mandarin G Extra, β-Naphthol Orange, Tropeolin OOO2, Mandarin, Chrysaurin.

Metanil Yellow—Orange M N, Tropeolin G, Victoria Yellow (O double conc.), Jaune G, Metanil Extra.

Sudun I—Carminnaphthe.

Orange IV—Orange IV, Orange N, Orange G S, New yellow, Acid yellow D, Tropeolin O O, Fast yellow, Diphenylorange, Diphenylamin Orange, Anilin yellow.

Naphthol Green B.

Methylene Blue B B G—Methylene Blue B B, in powder extra, Methylene Blue

D B B, extra, Methylene Blue B B (crystalline), Ethylene Blue, Methylene Blue B B.

Bismarck Brown—Bismarck brown G, Manchester brown, Phenylene brown, Vesuvin, Anilin brown, Leather brown, Cinnamon brown, Canelle, English brown, Gold brown.

Vesuvin B—Manchester brown E E, Manchester brown P S, Bismarck brown, Bismarck brown T.

Fast Brown G—Acid brown.

Chrysoidin—Chrysoidin G, Chrysoidin R, Chrysoidin J, Chrysoidin Y.

The anilin colors of the above lists are kept in stock under the names given, by most, if not all, of the large dye-houses of the country. These firms issue catalogues which state the effect of certain acids and alkalies upon the colors. This information is usually given to inquirers. As the colors are used by tablet-makers chiefly for tablets of special formulas, often outside the realm of medicine, it is impossible to indicate here the particular color to use. Experiment readily determines the dye suitable for producing a certain color or shade with sub-

stances of similar chemical natures. Dyes of fanciful names are usually some of the above colors, renamed, and are of doubtful freedom from arsenic and are expensive.

It is convenient to keep on hand small quantities of saturated alcoholic solutions of the dyes frequently used. As required, a definite amount of solution is mixed with the entire amount of moistening agent to be used in granulating. In fact, any coloring-agent in liquid form should be mixed, whenever possible, with the entire amount of moistening-agent to be used, in order to insure even coloration.

Natural colors are for the most part best kept in solution or tincture, and formulas serviceable for this purpose follow.

CARMIN SOLUTION

Carmin, No. 40	1 ounce
Ammonia water	2 drams
Water to make 16 ounces.	

Mix the carmin with the ammonia previously mixed with about two ounces of the water. Triturate until smooth. Gradually add the balance of the water, shaking occasionally until the carmin is practically dissolved. Filter.

This solution colors neutral or alkaline substances pink, but is unsuited for use with those possessing acid properties.

CUDBEAR TINCTURE

Cudbear . . . . 4 ounces
Alcohol to make 16 ounces.

This may be made equally well by maceration or percolation. It colors alkaline and neutral substances a purplish pink, and acid substances pink. The purplish cast may be largely counteracted by the addition of a small amount of caramel, though the brightness of the color is apt to be dimmed by the addition. Carmine solution is usually to be preferred.

Alkanet Root Tincture.

This is made exactly as Cudbear Tincture, using a moderately finely ground drug. It colors alkaline substances a good blue; neutral, purplish pink; and acid, pink.

Curcuma (Turmeric) Tincture.

Made with strong alcohol in the proportion given under Cudbear Tincture, the product colors a bright, light yellow.

Made with a menstruum of alcohol, two volumes, and water, one volume, a fair orange shade is produced.

CARAMEL SOLUTION

Good Caramel	1 volume
Water	1 volume

Mix thoroughly, using heat, if necessary. Caramel is suitable for producing light shades of brown. Difficulty in drying is experienced when sufficient quantity is used to produce a dark color. Recourse must be had, in such cases, to anilins.

Black and *Gray* are best produced by pure *Lampblack*. For black, no talcum or boric acid should be used in lubricating; their use produces gray.

Better results are obtained by coloring tablets light tints rather than deep shades. Vegetable colors and anilins, when mixed with damp masses, collect at the surface as the masses dry out. This phenomenon (due to capillary attraction) is well illustrated in a moulded tablet containing a vegetable color, such as is present in any tincture. A broken tablet of this kind exhibits a nearly white center and deeply colored surface. The same conditions exist in a single granule. When, therefore, a deep color is given to a granulation, on becoming dry, the exterior of each

granule is much darker than the interior. The granules become more or less broken in sifting and compressing, resulting in tablets showing light and dark spots. If, on the other hand, the granulation be merely distinctly tinted, the difference between the shades of color is scarcely noticeable, and tablets of even color result.

CHAPTER VIII

CONSTRUCTION OF FORMULAS

This important subject, the first step in actual tablet-manufacture, is dependent for its correct treatment upon a general knowledge of processes employed, the application of excipients, and the physical and chemical properties of the ingredients of the tablets to be made. In the foregoing chapters the author has endeavored to make clear the processes of manufacture, and the application of excipients. The properties of the ingredients are assumed to be known, and are, at all events, of easy access to the tablet-maker in many books of reference, such as the Dispensatories, Remington's Practice of Pharmacy, Coblentz' Handbook of Pharmacy, and others.

SYSTEMS OF WEIGHT

The system of weights to be used is of course optional. Arguments for and against the three systems—avoirdupois, apothecaries', and metric—are legion. The author has

used each for long periods both on the small and large scale, and without hesitation endorses the avoirdupois for tablet-manufacture, for the following reasons:

First, it is based on the grain as a unit of weight, which is as yet almost universally used in this country for the indication of doses. The use of the metric system necessitates constant conversion from grains to grams.

Second, substances entering into the composition of tablets are purchased by avoirdupois weight, and hence the use of the same system simplifies figuring tablet costs.

In using this system (which is used throughout this book) it is most convenient to make 7000 (or a multiple or fraction of 7000) tablets at one time. As the avoirdupois pound contains 7000 grains it follows that if 7000 tablets of—say—Calomel, one grain, are made, one pound of calomel is required; if 7000 one-fourth grain, then one-fourth pound; five grain, five pounds; etc. In other words, whatever number of grains enter into one tablet, the same number of pounds enter into 7000 tablets. In this lies

the extreme simplicity and partial safeguard from error.

In writing working-formulas, it is customary to place before each medicament, the number of grains required for one tablet, and after the medicament, in the same line, the quantity required for the lot, thus:

Grains		For 7000
3	Acetanilid	3 lb.
2	Quinine Sulphate	2 lb.
1/8	Codeine Sulphate	2 oz.

As compressed triturate tablets consist essentially of a small quantity of medicament diluted to a definite quantity with a base, while compressed tablets proper consist of a larger quantity of medicament, diluted as little as is necessary to yield a tablet which will be readily soluble, or will freely disintegrate, it is convenient to consider them, in formulating as separate classes.

COMPRESSED TRITURATE TABLETS

These are usually compressed in a 7-32 inch die, in which die 1 1/4 grains form a tablet of proper shape, and this size is here assumed as a standard. While a 3-16 inch die is used

for triturates by some manufacturers, it is too small to be used upon machines intended to compress large tablets as well. Small, fast-running machines, usually multiple, are used for these small-sized triturates, which appear to offer few advantages over the 7-32 inch size.

It was stated (p. 39) that equal parts of cane- and milk-sugar formed an excellent base. Without medicament, then, the formula for 7000 triturate tablets is

(a)	Cane-sugar	10 oz.
	Milk-sugar	10 oz.
		1¼ lb.

Moistening agent, water (about 2 ounces).
Die, 7-32 inch. Weight, 1¼ grains.

With this formula as a starting-point, a *general formula* is

x grains Medicament . . . . x lb.
Cane-sugar
Milk-sugar
Of each enough to make . . . . 1¼ pounds.
Die, 7-32 inch. Weight, 1¼ grains.

In formulating triturate tablets, the solubility of the medicament must be considered, as well as the proportion in which it enters into the tablets. Cane-sugar is soluble in about one half its weight of water at ordinary

temperature, while milk-sugar is soluble in about five times its weight, an average of 2¾ times their weight. The medicament entering into the tablets should displace an equal weight of the cane- or milk-sugar or of a mixture having as nearly as possible the solubility of the medicament. The object is to produce a granulation having about the solubility of equal parts cane- and milk-sugar. As illustrations, Citrated Caffeine, ¼ grain, and Calomel, ⅛ grain, serve well. The citrated caffeine has about the same solubility as cane-sugar; hence in the formula (a) above, the amount of medicament required replaces that amount of cane-sugar:

¼ Citrated Caffeine	4 oz.
Cane-sugar	6 oz.
Milk-sugar	10 oz.
	1¼ lb.

In the case of the calomel, we have an insoluble salt, and hence should replace the less soluble milk-sugar:

⅛ Calomel	2 oz.
Cane-sugar	10 oz.
Milk-sugar	8 oz.
	1¼ lb.

Triturate tablets of greater weight than 1 1/4 grains are often required, because of (a) the high specific gravity of one or more ingredients, or because of (b) the custom of compressing certain formulas in a 7-32 inch die, which from their weight would ordinarily be made in a larger die.

Illustrative of the former (a) are triturate tablets of calomel, mercuric iodide, mercurous iodide, reduced iron and its combinations, etc., in strengths exceeding 1/4 grain. By reason of their small volume, it is necessary to increase the quantity of base used with these substances in order to produce tablets of the usual thickness. One-quarter grain of any of the chemicals named above should be diluted to weigh 1 1/2 grains; 1/2 grain to 1 3/4 grains; and one grain to two grains. Thus the formula for *Mercurous Iodide, 1/2 grain*, is

1/2 Mercurous Iodide	8 oz.
Cane-sugar	14 oz.
Milk-sugar	6 oz.
	1 3/4 lb.

Die, 7-32 inch; weight, 1 3/4 grains.

As illustrations of "bulky" formulas (b), Citrated Caffeine, 1 gr.; Calomel, Ipecac, and

Soda ; Heart Stimulant, No. 1 ; and Pepsin, 1 gr., are good examples. While a few of this class of tablets can be compressed into the usual size and shape, it is at the expense of solubility or disintegration ; but as the 7-32 inch die is the customary size for those tablets whose combined medicinal ingredients do not exceed one grain, a heavier and thicker tablet containing proper excipients should be made.

Citrated Caffeine, 1 grain. (Very soluble medicament.)

1 Citrated Caffeine	1 lb.
Milk-sugar	8 oz.
	1½ lb.

Die, 7-32 inch ; weight, 1½ grains.

Calomel, Ipecac, and Soda. (Bulky, and medicaments weigh more than one grain. Customary triturate.)

1-5 Calomel	1400 gr.
1-10 Ipecac, po.	700 gr.
1 Sodium Bicarb	1 lb.
Cane-sugar	3150 gr.
	1¾ lb.

Die, 7-32 inch ; weight, 1¾ grains.

Heart Stimulant No. 1. (Requiring con-

siderable excipient to evenly distribute the extracts derived from the tinctures.)

¼	Tinct. Belladonna, U. S. P., 1890, 1-27 *Fl. Ext*	260 min.
2	Tinct. Digitalis, U. S. P., 1890, 3-10 *Fl. Ext*	2100 min.
2	Tinct. Strophanthus, U. S. P., 1890,	30 fl. oz.[1]
1-100	Nitroglycerin 1-10 gr. *10% solution*	700 gr.
	Starch	5 oz.
	Cane-sugar	6 oz.
	Milk-sugar	11¼ oz.
		1½ lb.

Die, 7-32 inch ; weight, 1½ grains.

In this case the proper quantities of fluid extracts (or even solid extracts) may be used in place of the tinctures, provided, of course, it is known that they fully represent their respective drugs. The alcohol is distilled or evaporated from the first three ingredients and the concentrated tincture further carefully evaporated to a soft extract. While still warm, the excipients are thoroughly mixed in and the mass forced through a number 16 sieve. The granulation being thoroughly dried, and sifted, the solution (ten per cent.) of nitroglycerin is poured on, mixed in lightly but thoroughly, and the whole dried

[1]Or, Tinct. Strophanthus, U. S. P., Eighth Revision, 15 fl. oz.

again, when it is ready for lubrication and compression.

The determination of the quantities and kinds of excipients in this formula is made as follows:

Belladonna leaf and digitalis yield about twenty-five per cent. of their weight in solid extract. Their fluid extracts, representing volume for weight of drug, yield the same. Then the combined volumes, 2360 minims yield about 590 grains of extract.

Thirty fluid ounces of Tinct. Strophanthus represent about 1½ ounces of drug, yielding about ten per cent., or 70 grains of solid extract, making a total of 660 grains. Solid extracts (p. 48) lose about twenty-five per cent. of their weight in drying out, the 660 grains thus yielding about 495 grains dry extract. Adding to this 70 grains of nitroglycerin (from the 700 grains of ten per cent. solution) gives a total of 565 grains of dry medicinal constituents.

In order to absorb these extracts, in a moist state, so that the finished tablets will have an even color, it is necessary to make the weight at least 1½ grains each, or 1½ pounds for 7000. That a tablet may disinte-

grate readily it requires from fifteen per cent. to twenty per cent. of its total weight of starch (p. 41). Five ounces is a convenient quantity. Six ounces of cane-sugar is ample for adhesive purposes, and the sum of the weights of all these ingredients subtracted from 1½ pounds leaves 11¾ ounces to be added. Milk-sugar is indicated in the double capacity of absorbent and base.

Pepsin, 1 grain

1 Pepsin, insoluble, powd.	1 lb.
Starch	5 oz.
Milk-sugar	3 oz.
	1½ lb.

Moistening agent, diluted alcohol.
Die, 7-32 inch; weight, 1½ grains.

Insoluble pepsin is preferred for tablet use, because it is less hygroscopic and more readily manipulated than the soluble variety. No cane-sugar should be used with pepsin because of its tendency to increase difficulty in drying out.

COMPRESSED TABLETS PROPER.

The construction of formulas for compressed tablets proper is perhaps best shown by an examination of typical formulas of various classes.

• 1. *Acetanilid, Aromatic.* (Type of tablets containing insoluble chemical requiring disintegrating powder, colored and flavored.)

5	Acetanilid	5 lb.
1-20	Oil Wintergreen	350 min.
	Erythrosin D	50 gr.
	Starch	1 lb. 3 oz.
	Milk-sugar	2 oz.
	Granulate with 8 ounces Acacia starch-paste, } Acacia	2 oz.
	Starch	1 oz.
	Total weight	6½ lb.

Die, ⅜ inch; weight, 6½ grains.

Following the principles laid down for the treatment of insoluble medicaments (p. 46), the first requirement is starch for disintegration. Twenty per cent. of the total weight of the granulation is the proper amount, and by taking twenty-five per cent. of the weight of the medicament, 1¼ pounds, a close approximation is obtained. From this, a 6½ grain tablet may be figured upon, or 6½ pounds for 7000 tablets. Starch is well introduced in all three ways in this tablet (p. 41): as powder, mixed with the acetanilid and other excipients; as paste, in conjunction with acacia; and as powder added to the granulation. The 1¼ pounds is divided as follows: eight ounces of acacia-starch-paste (p. 43)

contains 1 1/3 ounces starch; from three to five per cent. of the total weight, or, for convenience here, 2 2/3 ounces, may be added in powder to the finished granulation; and there remains just one pound to be mixed and granulated. Two per cent. of acacia in solution is ample for adhesion; eight ounces of acacia-starch-paste contains two ounces acacia, a sufficient quantity. This, however, will not moisten the powders enough for granulation and must be supplemented with water. In the latter, the color is dissolved and the solution mixed with the paste. The total weight of ingredients so far taken is 6 pounds 6 ounces, two ounces less than the required weight of 6 1/2 pounds, which weight is used for convenience in adjusting the finished tablets to the nearest quarter-grain, or 6 1/2 grains. Milk Sugar is best used in this case because, even in small proportion here required, it tends to prevent capping.

The mixing of such a formula as this is best accomplished, on the small scale, by strong trituration with mortar and pestle; on the large scale, in a spiral mixer (p. 26), until the color is uniformly distributed. Forced

through a number 12 to 16 sieve, dried, and sifted again through a sieve of the same mesh, the granulation is ready for the addition of flavoring oil (p. 51), powdered starch (withheld for this purpose), and any necessary lubricant. Lubricating oil is unnecessary with properly granulated acetanilid, and talcum is not always required, but, of course, may be used when necessary, up to two or three per cent.

2. *Alum Comp.* for Injection. (Type of tablet to be used for making a clear solution, and containing salts with water of crystallization.)

2½	Alum	2 lb. 8 oz.
2	Zinc Sulphate	2 lb.
1-32	Morphine Sulphate	219 gr.
1	Fluid Ext. Hydrastis, colorless, 1-40 grain *Hydrastine Sulphate*	175 gr.
	Milk-sugar	12 oz.
	Cane-sugar	12¼ oz.
	Boric Acid, powdered	4 oz.
	Total weight, dry	5 lb.

Die, 11-32 inch; weight, 5 grains.

Heated at 125° F., alum loses twenty-eight per cent. of its weight, or, of the above quantity, 11 ounces, leaving dry weight for the granulation, 1 pound 13 ounces. Zinc Sulphate, heat-

ed likewise, loses thirty-one per cent. of its weight, or 10 ounces, leaving dry 1 pound 6 ounces. These losses are made up with cane- and milk-sugars. The salts are weighed and dried out at the proper temperature, sifted (at least as fine as number 60), and mixed with the other ingredients. The morphine sulphate requires no comment. The fluid extract hydrastis, colorless, is figured on the assay of standard drug, containing two and one-half per cent. hydrastine (white alkaloid). No allowance has been made for the slightly larger amount of the sulphate, which strictly represents 1–40 grain of the alkaloid, because of its greater solubility. To insure even distribution of small quantities of alkaloidal salts they should be dissolved in water, with which the mixed powders (except the boric acid) are then granulated with water. The drying should be conducted at a temperature slightly above 125° F. Oil, of course, is not to be used as a lubricant in tablets for solution, except as a last resort. It is usually unnecessary with this formula, but a larger percentage than usual is required of boric acid. Allowance is therefore made in constructing the formula.

3. *Viburnum Comp.* (Type of tablet consisting chiefly of solid extracts.)

1 Extract Black Haw	1 lb.
1 Extract Cramp Bark	1 lb.
½ Extract Unicorn Root, true	8 oz.
½ Extract Unicorn Root, false	8 oz.
½ Extract Squaw Vine	8 oz.
¼ Caulophyllin	4 oz.
Starch	16 oz.
Yellow Dextrin	8 oz.
Liquorice Root, powdered	10 oz.
Total weight, dry	5 lb.

In this tablet the extracts are mixed and reduced as described on page 49, and the balance of the ingredients mixed in at the proper point. When dry and cool, the mass is ground to a number 16 or 20 granule, with precaution to avoid fine powder.

The amount of starch used is figured as usual. The drying out of the extracts is assumed to occasion a loss of twenty-five per cent. of their weight. Yellow dextrin is used to give stability to the mass, and liquorice root serves well as an absorbent and in adjusting the weight. It will often happen that the dry weight varies from the calculated weight, due to varying amounts of moisture in the extracts. In such cases, allowance must be made in the weight of the tablets,

when compressing. Oil is the best lubricant for this class of tablets, for reasons stated in the chapter on lubricating.

When proper facilities are at hand, the drugs which represent the extracts required are mixed, exhausted with seventy-one per cent. alcohol (alcohol, 3 volumes, water, 1 volume). The alcohol is, of course, recovered by distillation, and the extract reduced to brittleness, and treated as above. This method is profitably applied to tablets consisting chiefly of extracts of several kinds. It thus avoids the necessity of carrying in stock a variety of extracts having use in only one kind of tablet.

4. *Lozenges, Brown Mixture and Ammonium Chloride.*

85 min. Brown Mixture.

2	Ext. Liquorice, powdered	2 lb.
1-18	Opium, powdered	390 gr.
1-18	Acid, Benzoic	390 gr.
1-18	Camphor	390 gr.
1-18	Oil Anise	390 min.
1-44	Tartar Emetic	160 gr.
3	Ammonium Chloride, powdered	3 lb.
	Cane-sugar, powdered	14 lb. 4½ oz.
	Tragacanth, powdered	8 oz.
		20 lb.

Die, ⅝ inch ; weight, 20 grains.

The weight of extract of liquorice used is more than 85 minims of Brown Mixture requires. It is used to render the lozenges more palatable. Tragacanth is used as the adhesive in order to make the lozenges "smooth" while dissolving on the tongue, as well as hard. In mixing and granulating, the following procedure should be carried out: Mix the powdered opium, benzoic acid, and tartar emetic. Mix these with the extract liquorice, ammonium chloride, sugar, and tragacanth. Moisten, and granulate through number 16 sieve. Dry and sift. Mix the oil of anise with 1½ ounces lubricating oil, and dissolve the camphor in the mixture, using gentle heat if necessary. Mix and compress. Talc is occasionally required.

CHAPTER IX

TREATMENT OF INDIVIDUAL SUBSTANCES

Acetanilid.—Adhesive, acacia, two per cent. to three per cent. in mucilage. Disintegrator, starch, fifteen per cent. to twenty per cent., partly in paste. Lubricant, oil; talc seldom necessary. Small proportion milk-sugar tends to prevent capping. One per cent. solution of glycerin in diluted alcohol, sprayed on dry granulation, often remedies capping (See p. 82).

Acid, Arsenous.—Best kept in the form of a trituration to facilitate accurate weighing.

Arsenous Acid	1 part
Milk-sugar	9 parts
To make	10 parts

Treatment follows general method for triturate tablets (See p. 101).

Acid, Boric.—Adhesive, cane-sugar, twenty per cent. Lubricant, five per cent. of the boric acid, withheld from granulation.

Acid, Salicylic.—Adhesive, acacia, two per cent. to three per cent. in mucilage.

Disintegrator, starch, fifteen per cent. to twenty per cent., partly in paste. Lubricant, oil and talc. Avoid contact with iron.

Acid, Tannic.—Generally used in combination. Should be added, in fine powder, to other ingredients after they have been moistened for granulation. Avoid contact with iron.

Aloin.—One-half grain or less, general triturate method (p. 101). Over one-half grain, same treatment but larger tablet.

Alum.—Loses about twenty-eight per cent. of its weight in drying at 125° F. Should be weighed out, then dried, before mixing and granulating. Adhesive, cane-sugar, ten per cent. to twenty per cent. Lubricant, boric acid, two per cent. to five per cent.

Ammonium Bromide.—Alone, the granular salt, number 20 to 30, of snowy whiteness, should be used. Dry thoroughly at low temperature, and compress while still warm. No lubricant or excipient. In combination with other than white substances, the fine powder should be used. Avoid excess of moisture. In

combination with other white ingredients, the granular salt may be mixed with the balance of the granulation just before compressing.

Ammonium Chloride.—Treatment same as Ammonium Bromide.

Ammonium Iodide.—Treatment same as Ammonium Bromide.

Ammonium Salicylate.—Treatment same as Sodium Salicylate.

Antipyrine.—Treatment same as Acid, Salicylic.

Blaud Mass.—The potassium carbonate is mixed with the crystalline ferrous sulphate (previously ground coarsely). Cane-sugar in sufficient quantity to replace the water of crystallization in the iron salt (forty-five per cent. of its weight) is added at once; also enough milk-sugar to make up the total weight to the desired point. The mixture is heated on a water- or steam-bath, with constant stirring, until dry. Should reaction fail to commence shortly after the application of heat, a very small quantity of water is added. The addition, however, is rarely necessary.

In combination, the other medicaments and their excipients are mixed with the Blaud mass, toward the end of the above operation.

Blue Mass.—The official mass, without glycerin, may be treated as a solid extract (See p. 48). A more satisfactory tablet may be made by using a corresponding quantity of Mercury with Chalk in its stead. The latter is treated as Acid, Salicylic.

Caffeine.—One grain or less, general triturate method (p. 101). Over one grain, same treatment, but larger tablet.

Caffeine, Citrated.—On account of extreme solubility, citrated caffeine should replace the cane-sugar in the general triturate formula (p. 101). In tablets containing one grain or over, milk-sugar is a satisfactory excipient. Avoid contact with iron. In combination with acetanilid, citrated caffeine liberates acetic acid; hence, in formulas calling for these two compounds the citrated caffeine should be replaced by a corresponding quantity (fifty per cent.) of the alkaloid.

Calcium Sulphide (So called).—General triturate method (p. 101).

Calomel.—One grain or less, general triturate method (p. 101). On account of high specific gravity, tablets to contain ¼ grain should be made to weigh 1½ grains; ½ grain, 1¾ grains; and one grain, two grains; all on 7/32 inch die. Over one grain calomel, same treatment as Acid, Salicylic.

Camphor.—Owing to its volatile nature, camphor should be subjected to the least possible exposure to air or heat. Its tendency to cause picking is frequently a source of annoyance. In small proportions (five per cent. or less) it is best added to the otherwise finished granulation, in the form of a fine granule (number 40 or 50), lubricated with talcum before adding. This method is obviously permissible only when the balance of the granulation is white. In other cases it must be subjected to the usual process of mixing and granulating, and drying quickly at low temperature. Adhesive, acacia, two per cent. to three per cent., preferably in muci-

lage. Disintegrator, starch, fifteen per cent. to twenty per cent. Lubricant, talc.

Camphor, Monobromated.—While this and some other chemicals, such as terpin hydrate, salol, etc., can be compressed without previous treatment, they should, because of their insolubility, always be granulated with starch. Treatment same as Acid, Salicylic.

Cannabin.—Treatment same as Aloin.

Cascarin.—Treatment same as Aloin. Magnesium carbonate is a good absorbent, particularly if the cascarin has not been thoroughly freed from the oil of cascara, extracted with it in course of its manufacture.

Catechu.—Treatment same as Aloin.

Cerium Oxalate.—Treatment same as Acid, Salicylic.

Charcoal (Wood).—Wood charcoal is the least cohesive drug with which the tablet-maker has to deal, and is a difficult one to compress. For this reason some makers have been known to take the bull by the horns and use *animal* charcoal in its stead, which makes a most

beautiful tablet. As wood charcoal is always expected by prescribers, the practice of using animal charcoal in its place is not recommended.

Adhesives, cane-sugar, twenty per cent., with gelatin or tragacanth (in mucilage), ten per cent.

Lubricant, when necessary, oil. Talcum produces a gray color.

It frequently happens that such a granulation when dry will not form tablets of sufficient hardness. When this is the case, the thoroughly dried granulation is moistened slightly by spraying with water, and compressed in this condition. The damp tablets are then spread out to dry, when they will harden. This is the only substance in the author's experience (with the exception of Acetanilid, *q. v.*) which should not be perfectly dry during compression. It is essential, however, that the granulation be thoroughly dried before moistening a second time, in order that it may feed evenly into the die.

In combination, the characteristic absence of cohesion should be kept in

mind, always, however, using as little adhesive material as will accomplish the desired result.

Chloral, Hydrated.—This is an extremely soluble compound and somewhat hygroscopic in moist air. Cool, dry weather should, as far as possible, be selected for its manipulation. Under these conditions, it is readily passed through a number 16 sieve and compressed without excipient or lubricant.

Cinchonine Sulphate and Cinchonidine Sulphate (and Salicylate).—Treatment same as Quinine Sulphate.

Cocaine Hydrochloride.—This salt is rarely compressed except in combination. The usual 1 1/8 and 2 1/4 grain tablets for solution should be moulded. In combination, it should be dissolved in the moistening agent, to insure perfect subdivision and admixture.

Codeine and its Salts.—General triturate method (p. 101).

Copper Arsenite.—General triturate method (p. 101).

Corrosive Sublimate (Mercuric Chloride).—This salt has, as its name implies, a cor-

rosive action upon organic compounds; hence, sugars, starch, and other usual excipients are unsuited for use with it. The excipients generally used are ammonium chloride, sodium chloride, citric acid, and tartaric acid. As the solubility of corrosive sublimate is greatly increased by admixture with these compounds, the latter serve in double capacity. The chlorides act as lubricants as well as solvents, while the acids are also claimed to enhance the antiseptic value of corrosive sublimate by preventing the precipitation of albumen when the solution is applied to the tissues of the body.

Powdered corrosive sublimate of snowy whiteness should be used. Ammonium or sodium chloride, as the case may require, should be granular, and also snow-white. The powder is mixed with the granular salt, moistened with alcohol, and, without sifting, spread out on paper to dry, lubricated with boric acid, and compressed warm. Avoid contact with metal, especially when the granulation is moist.

For colored tablets, the color should be dissolved in the alcohol used for moistening; it is also better to use a very fine (number 40 or 50) granular ammonium or sodium salt to produce an even color.

For triturate tablets of corrosive sublimate, dissolve the medicament in enough alcohol to moisten the base, which best consists of one of the above-named granular salts.

It is an extremely difficult matter to compress tablets of corrosive sublimate in combination with citric or tartaric acid. Consequently such tablets are usually moulded.

Avoid personal contact with corrosive sublimate, especially in cuts, and avoid breathing in its dust.

Creosote.—This refers to *beechwood* creosote; the commercial creosote, so-called (crude carbolic acid), has no place in tablets. The treatment is the same as for oils and is fully considered under that heading, on page 51.

Digitalin.—General triturate method (p. 101). The "German" digitalin is in general use.

Dover's Powder.—The usual strengths called for are the ½, 1, 2½, and 5 grain. The ½ and 1 grain receive the general triturate method. The 2½ and 5 grain are each made in two forms: a triturate tablet *representing* the stated quantity of Dover's Powder, and a compressed tablet *containing* that quantity.

In the former, the proper weights of powdered opium and powdered ipecac are made into triturate tablets; in the latter the full quantity of Dover's powder is granulated with syrup and water (about two volumes of syrup and one of water), and compressed full weight. Lubricants, oil and talcum.

Ergotin.—Same treatment as Extracts.

Extracts.—See page 48.

Fowler's Solution.—The corresponding quantity of Potassium Arsenite is used. (See p. 134).

Gold and Sodium Chloride.—Same treatment as Corrosive Sublimate, triturates.

Guaiac (Resin).—As powdered guaiac usually contains more or less guaiac wood, which is irritating to the throat, care should be taken to use an article

free from that objection. For lozenges, the powder is diluted with sugar and granulated with tragacanth, five per cent. (in mucilage).

In combination, it is treated much as an extract. In throat tablets, insoluble excipients should be omitted.

Heroin and its Salts.—General triturate method (p. 101).

Iron, Reduced.—Mostly used in ½ or 1 grain strength in combination. As it is of high specific gravity, the weights of tablets containing it should be increased, as in calomel tablets (which see). When the weight of a tablet containing reduced iron will allow the use of about fifty per cent. of the weight of the iron in excipients, cane-sugar should be used. If this quantity will make too large a tablet, as much cane-sugar as possible should be used and supplemented with acacia (in ten per cent. mucilage) and starch. Lubricants, oil and talcum.

Lead Acetate.—Heated at 104°F., this salt loses about fourteen per cent. of its weight, water of crystallization. It is particularly troublesome in regard to

picking and sticking. Treatment: Dry out; add about twenty-five per cent. of its weight boric acid; granulate with syrup, three volumes, and water, one volume; lubricate with five per cent. to ten per cent. boric acid.

Lime.—The lime-water tablets of the market are legion, but few are of value. They are made usually, if not always, of slaked lime, which is practically worthless for the purpose, because, in drying out, a considerable part of the calcium hydroxide is converted into calcium carbonate.

Freshly burnt white marble or oyster-shell lime, in lumps, should be quickly broken with a hammer, ground to a number 12 granule, and the dust which will sift through a number 50 or 60 sieve discarded. Lubricated with about ten per cent. of talcum, and heated in a hot dryer, little difficulty is encountered in compressing. The tablets should be put immediately into dry, hot bottles, corked and sealed with an air-proof cap of paraffin, sealing-wax, or gelatin. In this condition, they will

keep indefinitely, and used in proper proportion will produce full strength lime-water. It is advisable to put not more than 100 tablets in one bottle, in order to prevent slaking by air when the bottle is opened.

Lithium Benzoate.—Diluent, milk-sugar, fifteen per cent. to twenty per cent. Adhesive, cane-sugar (as syrup). Lubricants, oil and talcum. Very soluble; avoid excess of moistening agent.

Lithium Carbonate.—Treatment same as Acid, Salicylic.

Lithium Citrate.—Treatment same as Lithium Benzoate. For effervescent tablets, see page 55.

Lithium Salicylate.—Treatment same as Sodium Salicylate.

Manganese Dioxide.—The U. S. P., Eighth Revision, recognizes only the precipitated variety, which should of course be used exclusively. Treatment same as Acid, Salicylic.

Menthol.—This volatile solid is best dissolved in any required medicinal oil (or, in the latter's absence, lubricating oil), and added to the dry granulation.

Mercury with Chalk.—Treatment same as Calomel.

Mercury (ic) Biniodide (Red).—General triturate method (p. 101). See also remarks concerning weights of tablets under Mercury Protiodide.

Mercury (ous) Protiodide (Yellow).—General triturate method. Must be carefully protected from light during all stages of preparation. Bottles should be wrapped in paper impervious to light. Tablets containing $\frac{1}{4}$ grain should weigh $1\frac{1}{2}$ grains; $\frac{1}{2}$ grain, $1\frac{3}{4}$ grains.

Mercury (ic) Chloride.—See Corrosive Sublimate.

Mercury (ous) Chloride.—See Calomel.

Morphine Sulphate — General triturate method.

Nitroglycerin.—The ten per cent. solution should be used. Avoid lights and fires. Also avoid personal contact with the liquid; it is dangerous in certain heart affections, and is productive of intense headache. The required quantity of the solution is mixed with a base of equal parts cane- and milk-sugar; dried

sufficiently, if necessary, to allow the addition of water for the purpose of granulation. General triturate method (p. 101).

Opium, powdered.—General triturate method (p. 101).

Papain, Papoid, etc.—Treatment same as Acid, Salicylic.

Pancreatin.—Treatment same as Pepsin.

Pepsin.—The insoluble variety is preferred for tablet-making, being less hygroscopic than the granular or scale pepsin. The addition of 20 per cent. of its weight of milk-sugar and granulation with alcohol produces an excellent tablet. Starch, also, answers well with the same treatment. In combination, the hygroscopic nature of pepsin should be borne in mind, and aqueous fluids be avoided as far as possible.

Phenacetine.—Treatment same as Acetanilid.

Phosphorus.—General triturate method. The required amount is dissolved in chloroform and mixed with the dry granulation. The weight of chloroform should be about two per cent. of the weight of the granulation. In large lots, the chloro-

form may be saturated with the phosphorus, added to a portion of the granulation, and this subsequently mixed with the balance. In all cases, the granulation, after being moistened with the solution, should be spread out in a cool place and mixed lightly by hand, until the chloroform has evaporated (no longer), then lubricated and compressed at once. The tablets, of course, should be bottled immediately, to prevent oxidation of the phosphorus.

Great caution must be observed in keeping and handling phosphorus. It is best kept immersed in water in a stone or porcelain jar. In weighing, first balance on the scales a suitable vessel such as a porcelain capsule containing water. Grasp a piece of phosphorus with a pair of forceps or tweezers and cut it as nearly as possible to the correct size, under water. Remove the excess of water quickly from the cut piece by means of filter- or blotting-paper and place in the vessel on the scale. When the required weight is obtained dry each piece separately as before and place in

the chloroform, contained in a bottle. To assist solution, the bottle may be placed in warm (not hot) water, and frequently shaken. Never handle phosphorus with the fingers. Many serious accidents have happened to over-confident ones, neglecting this precaution.

Phytolacca (*Poke*) *Juice.*—This should be expressed from the just ripe, fresh berries. A measured amount is brought to a boil in a tinned copper or agate-ware vessel, and strained. It is then concentrated at once, by gentle heat, to a soft extract. At this point a mixture of three parts milk-sugar and one part starch is added to the extract, in the proportion of twelve ounces of the mixture to each pint of juice used. After drying, milk-sugar is added in sufficient quantity to make each grain represent one minim of juice. The whole is then powdered and is designated *Poke-juice Trituration, 1 grain = 1 minim.* When a vacuum-pan with stirrer is available the process is best conducted therein, exactly as in making a powdered extract. As the characteristic color of fresh poke-juice is

not permanent in a moist condition, it is advisable for the manufacturer to prepare in the early autumn a sufficient amount of this trituration to supply his needs for the coming year. For the preparation of tablets, see Formulary, p. 196.

Podophyllin.—General triturate method (p. 101). As podophyllin in contact with the eye produces a very painful and at times lasting form of conjunctivitis, great caution should be used in its handling.

Potassium Arsenite.—This salt is quickly reduced by sugars, in the presence of water, to black metallic arsenic and other products. Hence, sugars or other reducing agents are unsuited for use in tablets containing this salt.

Granular ammonium or sodium chloride forms an admirable base for potassium arsenite. The best method of procedure is to mix the finely powdered arsenite with the granular salt, and moisten slightly with water. Spread out to dry, sift, and compress without lubricant. The resulting tablets are highly soluble and permanent.

The use of potassium arsenate or arsenous acid in place of potassium arsenite, as practiced by various manufacturers, is to be deprecated.

When Fowler's solution is indicated in tablet form, the equivalent in potassium arsenite should be used.

5 min. Fowler's Solution = about 1-20 grain Potassium Arsenite.
2 min. Fowler's Solution = about 1-50 grain Potassium Arsenite.
1 min. Fowler's Solution = about 1-100 grain Potassium Arsenite.

Potassium Bicarbonate.—This should be sifted, number 12 to 16, and dried, to remove any moisture contained in the crystals. It usually requires no lubricant.

Potassium Bromide.—Treatment same as Ammonium Bromide.

Potassium Chlorate.—This salt occurs in the market in three forms: large crystals (French); small crystals (English); and powdered. The French variety is preferred for making compressed tablets. The crystals are lightly ground in a perfectly clean mill, sifted number 16, and compressed hard without lubricant. The English variety requires no treatment,

other than warming, previous to compressing, but, as the crystals are in the form of small flakes, it is difficult to compress them into tablets of sufficient hardness.

In combination, the powdered form should be used, and handled with the usual precautions. It is dangerous in combination with ammonium salts and organic substances. With these it should never be triturated except in moist condition. When necessary to mix in a dry state, the mixing should be done lightly by hand or spatula.

Potassium Iodide.—Treatment same as Ammonium Bromide.

Potassium Nitrate.—Treatment same as Potassium Bicarbonate.

Potassium Permanganate.—This salt should be sifted, number 16 or 20. It may then usually be compressed. If capping persists, it may usually be remedied by sifting out the fine powder (number 50 or 60) and adding to the remaining granulation two or three per cent. of its weight of sodium bicarbonate. No lubricant is necessary.

Quinine Bisulphate.—Treatment same as Lithium Benzoate.

Quinine Sulphate.—This salt effloresces slowly in the air, and quite rapidly when heated. Exposed for a few hours to a temperature of 100° to 125° F., it loses about 10.5 per cent. of its weight of water of crystallization. This refers to the U. S. P. salt containing seven molecules of water. Some manufacturers prepare a quinine sulphate containing an excess of water. The method adopted by large users of quinine to prevent loss and to insure uniformity of strength is to dry the salt at a temperature of about 125° F. for several hours, and then add 11.5 per cent. of the weight, dried, of powdered starch. The resulting mixture is of uniform U. S. P. strength, and is used instead of the crystallized salt in compressed-tablet formulas. It is designated "Quinine trituration."

Treatment of the Trituration.—Adhesives, sugar, 10 per cent., and acacia, 5 per cent. Disintegrator, starch, 10 per cent. (in addition to that contained in the trituration).

As much as possible of the starch and acacia should be used in the form of acacia-starch-paste (p. 43).

Lubricants, oil and talcum (the latter mixed with starch).

Rhubarb.—This is usually in combination with sodium bicarbonate or magnesium carbonate. In order to prevent discoloration of the rhubarb by the action of the alkali upon it, recourse must be had to separate granulation. The rhubarb is well granulated with water alone. After drying and sifting, it is mixed with the alkaline granulation made as follows: Sodium Bicarb., q. s., Curcuma Powd., 3 per cent. of the weight of the Soda, Alcoholic Tinct. Shellac (orange), ten per cent. strength, enough to granulate.

The shellac here serves a double purpose: first, as an adhesive; second, as a preventive of reaction between the rhubarb and alkali. The curcuma colors the alkaline granulation so as to closely match the rhubarb in color, and thus produce a tablet of even color.

In small quantities, powdered rhubarb, mixed with an equal weight of sodium

bicarbonate, may be compressed without previous treatment, or lubricant, producing a very handsome tablet. On long runs, however, the process is not a great success, on account of difficulty in obtaining regular feeding, and the large proportion of powder which sifts from the shoe.

Saccharin, Garantose, etc.—General triturate method (p. 101). Mixed with an equal weight of sodium bicarbonate, its solubility is increased, and hence, also, its sweetening power. The two substances must be granulated separately in order to prevent reaction between them.

Salicin.—Treatment same as Acid, Salicylic.

Salol (Phenyl Salicylate).—The melting-point of salol is about 108° F. Drying operations of salol, or of mixtures containing it, should therefore be conducted at a temperature below that point. Alone, salol is best mixed with 20 per cent. of its weight of starch, and granulated with a mixture of equal volumes of syrup and alcohol. In combination, it is usually present in so small a proportion as to render special treatment

unnecessary, except precaution as to temperature.

Advantage may sometimes be taken of the low melting-point of salol, to produce granulation. By mixing all the ingredients, and stirring while heating to the temperature at which the salol begins to melt, the mass will usually become granular. On cooling, sifting, and, if necessary, lubricating, the granulation may be compressed at once. The temperature must be carefully controlled, in order to prevent the decomposition of the salol, which results in mottled tablets.

Santonin.—General triturate method (p. 101). Must be rigidly protected from light. See remarks under Mercury (ous) Protiodide, Yellow.

Sodium Arsenate.—General triturate method (p. 101). This highly poisonous salt is more or less efflorescent, and therefore of uncertain strength. In order to insure accuracy of dose, the exsiccated salt (U. S. P., Eighth Revision) should be mixed with sixty-eight per cent. of its weight of well-dried milk-sugar. This

trituration, if kept well stoppered, is of uniform strength with the crystallized salt, and should be used weight for weight instead of the crystals.

Sodium Benzoate.—Treatment same as Lithium Benzoate.

Sodium Bicarbonate.—Adhesive, acacia solution, twenty per cent. strength, sufficient to moisten. Drying should be conducted at a low temperature (about 110 ° F.) and the heating discontinued as soon as the granulation is dry, in order to prevent discoloration. Granulation with cane-sugar usually discolors upon drying.

As sodium bicarbonate reacts with various chemicals—calomel, acetanilid, saccharin, etc.—in the presence of water, it is necessary to prepare two granulations for tablets containing such combinations. For this purpose a number 20 granulation of this salt, freed from fine powder, should be kept on hand.

A number 16 granulation serves as a base for Soda-mint tablets, and should be stocked accordingly.

Sodium Bromide.—Treatment same as Ammonium Bromide.

Sodium Phosphate, Dried.—Diluent, milk-sugar. Adhesive, cane-sugar, ten per cent. to fifteen per cent. Lubricants, oil and talcum.

Sodium Salicylate.—This substance has, perhaps, the worst reputation for general meanness, in its attitude toward the long-suffering tablet-maker, of any with which he has to deal. It picks and it sticks more persistently than any other common ingredient of tablets. After much tribulation in this respect, the following treatment was pursued by the author for severai years, with gratifying success: Adhesive, gelatin or best white glue (in solution), fifteen per cent. Disintegrator, starch, powder, fifteen per cent. to twenty per cent. After drying and sifting, number 12, the fine powder (number 50) is sifted out and reserved for a subsequent granulation. Lubricants, oil, one per cent.; talcum, three per cent., mixed with starch, two per cent. Oil of Wintergreen, usually required for flavoring, is sprayed on the finished tablets.

Sodium Sulphocarbolate.—Treatment same as Potassium Bicarbonate.

Sparteine Sulphate.—General triturate method (p. 101). Very soluble; avoid excess of water.

Strontium Bromide and Strontium Iodide.—Treatment same as Ammonium Bromide. Very deliquescent; avoid contact with moist air, or moisture in any form. Strontium Iodide should be protected from light.

Strontium Salicylate.—Treatment same as Sodium Salicylate.

Strychnine and its Salts.—Treatment same as Acid, Arsenous.

Sulphur.—Washed and precipitated sulphur are the only forms which should be used in tablets intended for internal use. Treatment same as Acetanilid.

Tartar Emetic.—General triturate method (p. 101).

Terpin Hydrate.—Treatment same as Camphor, Monobromated.

Tinctures.—See page 47.

Tully's Powder.—Treatment same as Acid, Salicylic. Quick drying at low temperature is necessary to prevent undue volatilization of the camphor contained in Tully's powder. It is better added

in fine granules (number 40 or 50) to the otherwise finished granulation.

Turpeth Mineral.—The principal use to which this salt is put is the treatment of croup in infants and children. On account of the rapid progress of the disease, it is essential that tablets of turpeth mineral be freely soluble or capable of quickly disintegrating. While moulded tablets are to be preferred, compressed tablets, rightly made, answer the purpose and are treated in the same manner as Acid, Salicylic.

Zinc Phosphide.—General triturate method (p. 101).

Zinc Sulphocarbolate.—Granulate with syrup and water, equal volumes. Lubricants, oil and talcum.

CHAPTER X

FORMULARY

While no attempt has been made to give a "Complete Formulary," it has been the endeavor of the author to present here a large variety of typical formulas, covering at least one example of each of the most commonly used drugs and combinations. It must not be expected that perfect tablets will always result from the use of these formulas, for as much depends upon intelligent and painstaking manipulation as upon the formula. Nor is any claim made that the formulas themselves are perfect; they are simply the result of a number of years' constant endeavor on the part of the author to produce ever better tablets during the busy course of their manufacture.

For the sake of convenience and uniformity all formulas herein given are for 7,000 tablets. The figures standing before the ingredients indicate the number of grains of solids, or minims of liquids, in one tablet. The system of weight used is the avoirdupois (See page 98).

When starch-paste, or sugar- or gum-starch paste, etc., are indicated as granulating agents, sufficient water is to be added whenever necessary to produce the proper degree of moisture. Unless otherwise specified, the moistening agent is

water. Also, unless otherwise stated, the lubricants are oil followed by talcum.

The formulas containing extracts refer to *solid* extracts, and the excipients are so adjusted as to replace the moisture contained in them. If powdered extracts are used, the quantities of excipients should be reduced accordingly.

Absorbent Dyspeptic

1	Pepsin	1	lb.
2	Charcoal	2	lb.
2½	Sodium Bicarb	2½	lb.
	Starch	1	lb.
	White Dextrin	½	lb.
	Total weight,	7	lb.

Lubricant, oil.

Die, ⅜ inch. Weight, 7 gr.

Acetanilid, 1 Gr.

1	Acetanilid	1	lb.
	Starch	5	oz.
	Milk-sugar	2	oz.
	Acacia-starch-paste	2½	oz.
	Total weight dry,	1½	lb.

Lubricant, talcum with starch.

Die, ¼ inch. Weight, 1½ gr.

Acetanilid Aromatic

(See page 108)

5	Acetanilid	5 lb.
1-20	Oil Wintergreen	350 min.
	Pink Color (Erythrosin D)	50 gr.
	Starch	1 lb. 3 oz.
	Milk-sugar	2 oz.
	Acacia-starch-paste	8 oz.

Total weight dry, 6½ lb.

Lubricant, if necessary, talcum with starch.

Die, ⅜ inch. Weight, 6½ gr.

Acetanilid Comp., 5 Gr.

(DR. AULDE)

3½	Acetanilid	3½ lb.
½	Caffeine, Alkaloid	½ lb.
1	Sodium Bicarb	1 lb.
	Starch	11 oz.
	Milk-sugar	2 oz.
	Acacia-starch-paste	8 oz.

Total weight dry, 6 lb.

Mix all ingredients except sodium bicarb., and granulate. When dry, mix with the latter in number 16 granulation. (See page 140) Lubricant, talcum with starch.

Die, ⅜ inch. Weight, 6 gr.

Acid, Arsenous, 1-100 Gr.

1-100 Acid, Arsenous, = 1-10 *Trituration*,
10 = 1 (p. 115) .... 700 gr.
Cane-sugar .... 10 oz.
Milk-sugar .... 3675 gr.

Total weight, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Acid, Boric, 5 Gr.

5 Acid, Boric, powdered .... 5 lb.
Cane-sugar .... 1 lb.

Total weight, 6 lb.

Lubricant, 4 oz. boric acid, withheld from granulation.

Die, ⅜ inch. Weight, 6 gr.

Acid, Salicylic, 5 Gr.

5 Acid, Salicylic .... 5 lb.
Starch .... 1 lb.
Cane-sugar .... 3 oz.
Acacia-starch-paste .... 12 oz.

Total weight dry, 6½ lb.

Lubricants, oil and talcum with starch.
Avoid contact with iron.

Die, ⅜ inch (or 13-32). Weight, 6½ gr.

Aconite, Tincture, 2 Minims

2	Aconite Tr.* = *7-10 Fl. Ext*	10¼	oz.
	Cane-sugar	4	oz.
	Milk-sugar	14	oz.
	Total weight dry,	1¼	lb.
	Die, 7-32 inch. Weight,	1¼	gr.

Aconite and Bryonia Comp.

1	Aconite Tr.* = *.35 Fl. Ext*	⅛	oz.
1⅞	Gelsemium Tr. * = *.28 Fl. Ext*	4⅛	oz.
1¼	Bryonia Tr. * = ⅛ *Fl. Ext*	875	m.
	Cane-sugar	4	oz.
	Milk-sugar	14	oz.
	Total weight dry,	1¼	lb.
	Die, 7-32 inch. Weight,	1¼	gr.

Aloin, 1-4 Gr.

¼	Aloin	4	oz.
	Cane-sugar	6	oz.
	Milk-sugar	10	oz.
	Total weight,	1¼	lb.
	Die, 7-32 inch. Weight,	1¼	gr.

Aloin, Belladonna, and Strychnine

⅕	Aloin	1400	gr.
⅛	Ext. Belladonna	2	oz.

* U. S. P. 1890.

1-60	Strychnine Sulph. = 1/6 *Trituration. 10 = 1* (p. 142)	1333	gr.
	Cane-sugar	2800	gr.
	Milk-sugar	7	oz.

Total weight dry, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Aloin, Bellad., Strychnine, and Ext. Cascara.

1/5	Aloin	1400	gr.
1/8	Ext. Belladonna	2	oz.
1-120	Strychnine Sulph. = *1-12 Trituration, 10 = 1* (p. 142)	583	gr.
½	Ext. Cascara	8	oz.
	Starch	4	oz.
	Milk-sugar	4	oz.

Total weight dry, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Alum Comp.

(See p. 110)

2½	Alum	2½	lb.
2	Zinc Sulphate	2	lb.
1-32	Morphine Sulphate	½	oz.
1	Fl. Ext. Golden Seal (colorless) = *1-40 Hydrastine Sulphate*	175	gr
	Milk-sugar	12	oz.
	Cane-sugar	12½	oz.
	Boric Acid, powdered (Lubricant)	4	oz.

Total weight dry, 5 lb.

Die, 11-32 inch. Weight, 5 gr.

Ammonium Bromide, 5 Gr.

5 Ammonium Bromide, No. 30 .... 5 lb.
Die, 5-16 inch. Weight, 5 gr.
Compress warm.

Ammonium Bromide, 10 Gr.

10 Ammonium Bromide, No. 30.......... 10 lb.
Die, 13-32 inch. Weight, 10 gr.
Compress warm.

Ammonium Chloride, 5 Gr.

5 Ammonium Chloride, gran. .... 5 lb.
Die, 3/8 inch. Weight, 5 gr.

Ammonium Chloride Comp., with Codeine

1/4	Ammonium Chloride, powdered ...	4 oz.
1-10	Ext. Liquorice	700 gr.
1/8	Cubeb, powdered (No. 100).......	2 oz.
1-25	Codeine, Alkaloid	280 gr.
	Cane-sugar	3 oz. 333 gr.
	Milk-sugar	8 oz.
	Total weight,	1 1/4 lb.

Die, 7-32 inch. Weight, 1 1/4 gr.

Anodyne

1/8	Camphor......................	2 oz.
1/8	Ext. Hyoscyamus..............	2 oz.
1-60	Morphine Sulphate.............	117 gr.

1-60	Oleoresin Capsicum	117	min.
	Cane-sugar	6	oz.
	Milk-sugar	10	oz.

Total weight dry, 1¼ lb.

Dry quickly at low temperature. Add oleoresin with lubricant. Lubricant, oil.

Die, 7-32 inch. Weight, 1¼ gr.

Antiasthmatic

2	Potas. (or Sod.) Iodide, granular	2	lb.
2	Potas. (or Sod.) Bromide, granular	2	lb.
3	Fl. Ext. Euphorbia Pil.	43¾	oz.
2	Tr. Lobelia,* — *3 Fl. Ext.*	2100	min.
1-200	Nitroglycerin, — *1-20, 10% sol.*	350	min.

Total weight dry, 4½ lb.

Evaporate the fluid extracts to soft extract and mix with granular salts. Dry at low temperature. Sift, add solution nitroglycerin, dry, sift, and compress warm. No lubricant.

Die, 5-16 inch. Weight, 4½ gr.

Anticonstipation

1	Ext. Cascara Sagrada	1	lb.
⅛	Ext. Nux Vomica	2	oz.
⅛	Ext. Belladonna	2	oz.
⅛	Ipecac, powdered	2	oz.
⅛	Podophyllin	2	oz.

* U. S. P. 1890.

Starch	7	oz.
Milk-sugar	6	oz.

Total weight dry, 2 lb.

Warm the extracts together on bath, mix in balance of ingredients, and pull apart. Dry on tinned trays, dusted with starch.

Die, $\frac{1}{4}$ inch. Weight, 2 gr.

Antidyspeptic

1-60	Strychnine Sulphate, — 1/6 *Trituration, 10 — 1* (p. 142)	1333	gr.
1-10	Ipecac, powdered	700	gr.
$\frac{1}{4}$	Capsicum, powdered	4	oz.
$\frac{1}{4}$	Ext. Rhubarb	4	oz.
$\frac{1}{2}$	Ext. Gentian	8	oz.
2	Sodium Bicarb	2	lb.
	Starch	1	lb.
	Yellow Dextrin	6	oz.

Total weight dry, $4\frac{1}{2}$ lb.

Mix same as Anticonstipation.

Die, 5-16 inch. Weight, $4\frac{1}{2}$ gr.

Antiseptic, Alkaline

5	Sodium Bicarb	5	lb.
5	Sodium Borate	5	lb.
5	Sodium Chloride *	5	lb.
7-24	Sodium Benzoate	$4\frac{1}{2}$	oz.

* A high-grade white table-salt is suitable for use in this formula.

7-48	Sodium Salicylate	2¼ oz.
	Eucalyptol	1½ oz.
	Menthol	¾ oz.
	Thymol	¾ oz.
	Oil Wintergreen	¾ oz.
	Total weight,	15⅔ lb.

Mix the salts and granulate with a mixture of 2 oz. syrup and 16 oz. water. Mix the eucalyptol and oil wintergreen, and in the mixture dissolve the menthol and thymol. Mix with the dry granulation. No lubricant. This formula will produce a freely soluble tablet yielding a nearly clear solution in 2 oz. of water, which solution produces little if any smarting when applied to the nasal passages.

Die, 9-16 inch. Weight, 15¾ gr.

Antiseptic, Wilson, White

7.7	Corrosive Sublimate, powdered	7.7 lb.
7.3	Ammonium Chloride, granular.....	7.3 lb.
	Boric Acid (Lubricant)	8 oz.
	Total weight,	15½ lb.

Care must be exercised to select snow-white salts. Moisten the granular ammonium chloride with alcohol. Mix intimately with the powdered corrosive sublimate. Spread out to dry. When thoroughly dry, sift (number 16), add the boric acid, and compress warm.

Die, ½ inch. Weight, 15½ gr.

Antiseptic, Wilson, Blue

7.7	Corrosive Sublimate, powdered	7.7 lb.
7.3	Ammonium Chloride, powdered ...	7.3 lb.
	Aniline Blue	50 gr.
	Boric Acid (Lubricant)	8 oz.
	Total weight,	15½ lb.

Dissolve the color in sufficient alcohol to moisten the ammonium chloride, and proceed exactly as in Antiseptic, Wilson, White.

Aphrodisiac

2	Ext. Damiana	2 lb.
1/8	Ext Nux Vomica................	2 oz.
1-10	Zinc Phosphide..................	700 gr.
1-25	Cantharides, powdered	280 gr.
	Starch........................	8 oz
	Milk-sugar	4 oz
	Total weight dry,	2½ lb.

Die, 5-16 inch. Weight, 2½ gr.

Asafetida, 2 Gr.

2	Asafetida, purified	2 lb.
	Starch	8 oz.
	Total weight dry,	2 lb

Treat as an extract.

Die, 9-32 inch. Weight, 2 gr.

Astringent Wash

2	Lead Acetate	2 lb.
2	Zinc Acetate	2 lb.
1-20	Berberine Hydrochloride	350 gr.
1-32	Morphine Acetate	½ oz.
	Milk-sugar	24¾ oz.
	Total weight dry,	5 lb.

Dried at 104° F., lead acetate loses 14¼ % of its weight, and zinc acetate 16½ %. The combined losses are 10 oz. Weigh and dry out before granulating. Granulate with syrup and water, equal volumes. Lubricant, boric acid.

Die, 5-16 inch. Weight, 5 gr.

Atropine Sulphate 1-100 Gr.

See Acid, Arsenous, 1-100 gr.

Belladonna, Extract, 1-4 Gr.

¼	Ext. Belladonna	4 oz.
	Cane-sugar	7 oz.
	Milk-sugar	10 oz.
	Total weight dry,	1¼ lb.

To develop and evenly distribute the natural color of an extract where water fails, use an alcoholic menstruum as nearly as possible of the strength as that used in making the extract.

Die, 7-32 inch. Weight, 1¼ gr.

Beta-Naphtol, 5 Gr.

See Acid, Salicylic, 5 gr.

Beta-Naphtol Comp.

1	Beta-Naphtol	1 lb.
1	Bismuth Salicylate (basic)	1 lb.
1	Aromatic Chalk Powder	1 lb.
	Starch	8 oz.
	Total weight,	3½ lb.

Die, 5-16 inch. Weight, 3½ gr.

Bismuth, Calomel Comp.

1	Bismuth Subnitrate	1 lb.
1-40	Calomel	175 gr.
1-60	Ipecac, powd.	117 gr.
	Starch	6 oz.
	Cane-sugar	4 oz.
	Acacia-starch-paste	4 oz.
	Total weight dry,	1¾ lb.

Die, 7-32 inch. Weight, 1¾ gr.

Bismuth Subgallate, 5 Gr.

See Acid, Salicylic, 5 gr.

Die, ⅜ inch. Weight, 6½ gr.

Bismuth Subnitrate, 5 Gr.

See Acid, Salicylic, 5 gr.

Die, 11-32 inch. Weight, 6½ gr.

Bitter Tonic

1	Wine Ipecac = *1-10 Fl. Ext.*	700	min.
2	Tr. Capsicum = *1-80 Oleores*	88	min.
5	Tr. Nux Vomica = *1-10 Ext.*	700	gr.
5	Tr. Gentian Comp. = *1 Fl. Ext.*	14⅝	oz.
	Cane-sugar	3	oz.
	Milk-sugar	12	oz.

Total weight dry, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Blaud, 5 Gr.

5	Blaud Mass =		
	2½ Iron Sulph., cryst.	2½	lb.
	1½ Potas. Carbonate	1½	lb.
	Cane-sugar	10	oz.
	Milk-sugar	10	oz.

Total weight dry, 5 lb.

(See p. 117)

If a ball mill is available, the milk-sugar should be replaced by starch, and after drying the mixture, it should be triturated to fine powder and granulated, with 10% acacia-mucilage.

Die, 11-32 inch. Weight, 5 gr.

Blaud and Manganese Comp.

(Anæmia.)

3	Blaud Mass =		
	1½ Iron Sulph., cryst.	1½	lb.
	9-10 Potas. Carbonate	6300	gr.
1	Manganese Dioxide	1	lb.

1-60	Acid Arsenous, = $\frac{1}{6}$ Trituration, 10 = 1	1167	gr.
	Cane-sugar	12	oz.
	Milk-sugar or starch *	13	oz.
	Total weight dry,	5	lb.

Die, 11-32 inch. Weight, 5 gr.

Blaud Tonic Laxative

3	Blaud Mass,		
	1½ Iron Sulph., cryst	1½	lb.
	9-10 Potas. Carbonate	6300	gr.
½	Quinine Sulph., Trit. (p. 136)	8	oz.
1-10	Aloin	700	gr.
1-10	Ext. Nux Vomica	700	gr.
1-10	Aloin	700	gr.
	Cane-sugar	12	oz.
	Milk-sugar or starch *	13	oz.
	Total weight dry,	4½	lb.

Die, 11-32 inch. Weight, 4½ gr.

Blue Mass, 5 Gr.

5	Blue Mass	5	lb.
	Starch	1½	lb.
	Total weight dry,	6	lb.

Die, 11-32 inch. Weight, 6 gr.

* See under Blaud, 5 gr., above.

Bronchial

$\frac{1}{3}$	Ammonium Chloride, powdered	$5\frac{1}{3}$	oz.
1	Ext. Liquorice, powdered	1	lb.
$\frac{1}{5}$	Balsam Tolu	$3\frac{1}{5}$	oz.
$\frac{1}{3}$	Oleores. Cubeb	$5\frac{1}{3}$	oz.
$\frac{1}{4}$	Hyoscyamus, powdered	4	oz.
$\frac{1}{5}$	Senega, powdered	$3\frac{1}{5}$	oz.
1-50	Ipecac, powdered	140	gr.
	Magnesia, Calcined	2	oz.
	Cane-sugar	2	lb.
	Milk-sugar	$1\frac{1}{2}$	lb.
	Tragacanth, powdered	8	oz.
	Mucilage, Tragacanth 5%	8	oz.
	Total weight dry,	6	lb.

(Not counting Oleores. Cubeb.)

Die, 13-32 inch. Weight, 6 gr.

Warm the balsam tolu with about 4 ounces alcohol, until dissolved. Add the calcined magnesia, evaporate to dryness, and powder. Mix with balance of powders and granulate. After compressing, mix the oleoresin cubeb with enough oil (almond, peanut, or mustard expressed oils are good) to make 7,000 drops (see p. 53), and put one drop on each tablet.

Bronchitis

1-40	Ext. Bellad	175	gr.
1-10	Dover's Powder	700	gr.

1-20	Ipecac, powdered	350	gr.
¼	Quinine Sulph., Trit. (p. 136)	4	oz.
	Cane-sugar	10	oz.
	Milk-sugar	3¾	oz.

Total weight dry, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Brown Mixture, 1 Dr.

1-10	Ext. Liquorice, powdered	700	gr.
1-25	Opium, powdered	280	gr.
1-25	Camphor	280	gr.
1-25	Benzoic Acid	280	gr.
1-25	Oil Anise	280	min.
1-60	Tartar Emetic	117	gr.
	Cane-sugar	7oz. 250	gr.
	Milk-sugar	8	oz.

Total weight, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Granulate all except the camphor and oil anise. When dry, dissolve the camphor in the oil and add to the granulation. Lubricant, talcum.

Brown Mixture Comp.

60	Brown Mixture (Medicaments as above.)	4 oz. 187	gr.
1	Ammon. Chloride, powdered	1	lb.
	Cane-sugar	3 oz. 250	gr.

Total weight, 1½ lb.

Treat as Brown Mixture, 1 Dr.

Die, ¼ inch. Weight, 1½ gr.

Caffeine, Citrated, 1-2 Gr.

½	Caffeine, Citrated.*	
	= { ¼ Caffeine Alkaloid	4 oz.
	{ ¼ Citric Acid	4 oz.
	Milk-sugar	12¾ oz.

Total weight dry, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Calcium Sulphide, 1-4 Gr.

¼	Calcium Sulphide	4 oz.
	Cane-sugar	10 oz.
	Milk-sugar	6 oz.

Total weight, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Calomel, 1-10 Gr., Pink, Flavored

1-10	Calomel	700 gr.
	Pink Color (Erythrosin D)	10 gr.
	Oil Wintergreen	Spray.
	Cane-sugar	10 oz.
	Milk-sugar	3665 gr.

Total weight, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

* While not exact, it is customary in manufacturing, to consider Citrated Caffeine as consisting of equal parts Caffeine and Citric Acid.

Calomel, 1-4 Gr.

¼	Calomel	4 oz.
	Cane-sugar	12 oz.
	Milk-sugar	8 oz.

Total weight, 1½ lb.

Die, 7-32 inch. Weight, 1½ gr.

Calomel, Ipecac, and Soda

⅕	Calomel	1400 gr.
1-10	Ipecac, powdered	700 gr.
1	Sodium Bicarbonate	1 lb.
	Cane-sugar	3150 gr.

Total weight, 1¾ lb.

Die, 7-32 inch. Weight, 1¾ gr.

Calomel and Soda, No. 1

1-10	Calomel	700 gr.
1	Sodium Bicarb., gran. (p. 140)	1 lb.
	Cane-sugar	4550 gr.

Total weight, 1¾ lb.

Mix the calomel with the sugar, granulate, dry, and sift. Mix with the sodium bicarbonate granulation (carefully dried), lubricate with talcum, and compress.

Die, 7-32 inch. Weight, 1¾ gr.

Calomel and Soda, No. 2

1	Calomel	1 lb.
1	Sodium Bicarb., gran. (p. 140)	1 lb.
	Cane-sugar	4 oz.
	Total weight,	$2\frac{1}{4}$ lb.

Treat same as No. 1.

Die, 7-32 inch. Weight, $2\frac{1}{4}$ gr.

Camphor, Hyoscyamus, and Valerian

1	Camphor	1 lb.
$\frac{1}{2}$	Ext. Hyoscyamus	8 oz.
$\frac{1}{2}$	Ext. Valerian	8 oz.
	Starch	12 oz.
	Milk-sugar	14 oz.
	Total weight dry,	3 lb.

Dry as quickly as possible at low temperature.

Die, 5-16 inch. Weight, 3 gr.

Camphor, Monobromated, 3 Gr.

3	Camphor, monobromated, powdered	3 lb.
	Starch	12 oz.
	Cane-sugar	1 oz.
	Acacia-starch-paste	8 oz.
	Total weight dry,	4 lb.

Die, 11-32 inch. Weight, 4 gr.

Cannabis Indica, Ext., 1-4 Gr.

1/4	Cannabis Indica, Ext.	4 oz.
	Calcined Magnesia	2 oz.
	Cane-sugar	5 oz.
	Milk-sugar	10 oz.
	Total weight dry,	1¼ gr.

Lubricant, oil.

Die, 7-32 inch. Weight, 1¼ gr.

Cascara Sagrada, Ext., 2 Gr.

2	Cascara Sagrada, Ext.	2 lb.
	Magnesium Carbonate (or Oxide)	6 oz.
	Starch	6 oz.
	Total weight dry,	2¾ lb.

Die, 9-32 inch. Weight, 2¾ gr.

Cascara Sagrada, Fl. Ext., 5 Min.

Same as Extract, 2 Gr., above.

Cascara Comp.

2	Ext. Cascara Sagrada	2 lb.
1/8	Podophyllin	2 oz.
1-16	Ext. Belladonna	1 oz.
	Magnesium Carbonate (or Oxide)	5 oz.
	Starch	4 oz.
	Total weight dry,	2¾ lb.

Die, 9-32 inch. Weight, 2¾ gr.

Cathartic, Active

1-10	Aloin	700	gr.
1-5	Podophyllin	1400	gr.
1-10	Ext. Colocynth Comp.	700	gr.
1-10	Ext. Nux Vomica	700	gr.
1-120	Oleores. Capsicum	58	min.
1-15	Croton Oil	467	min.
	Cane-sugar	3	oz.
	Milk-sugar	12	oz.
	Total weight dry,	1½	lb.

Granulate all except the oleoresin capsicum and croton oil; these, mixed, serve as lubricant.

Die, 7-32 inch. Weight, 1½ gr.

Cathartic Comp.

(Liver Tablets.)

1-32	Leptandrin	½	oz.
1-10	Aloin	700	gr.
1-6	Podophyllin	1167	gr.
1-28	Oleoresin Capsicum	250	min.
1-16	Ext. Hyoscyamus	1	oz.
	Cane-sugar	4½	oz.
	Milk-sugar	10	oz.
	Total weight dry,	1¼	lb.

Die, 7-23 inch. Weight, 1¼ gr.

Cathartic Comp., U. S. P.

1¼	Ext. Coloc. Comp.	1¼	lb.
1	Calomel	1	lb.

½	Ext. Jalap	8 oz.
¼	Gamboge, powdered	4 oz.
	Starch	10 oz.
	Total weight dry,	3½ lb.

Die, 5-16 inch. Weight, 3½ gr.

Charcoal, 5 Gr.

5	Charcoal, wood	5 lb.
	Cane-sugar	1 lb.
	Gelatin or Tragacanth (in mucilage)	8 oz.
	Total weight dry,	6½ lb.

Die, 7-16 inch. Weight, 6½ gr.

The mixture should be well moistened and, after granulation, *thoroughly* dried. If difficulty is found in compressing sufficiently hard, the granulation should be slightly moistened by spraying with water, compressed while still moist, and the tablets dried. Lubricant, oil if necessary; talcum produces gray tablets.

Charcoal and Soda

3	Charcoal, wood	3 lb.
2	Sodium Bicarbonate	2 lb.
	Cane-sugar	2 lb.
	Total weight,	7 lb.

Lubricant, oil.

Die, 13-32 inch. Weight, 7 gr.

Chloral, Hydrated, 5 Gr.

5	Chloral, Hydrated (No. 16)	5	lb.
	Die, 11-32 inch.	Weight, 5	gr.

(See page 122).

Chlorodyne

1/8	Morphine Hydrochloride	1167	gr.
1/4	Ext. Cannabis Indica	4	oz.
1-300	Nitroglycerin = 1-30 10 % *Solution*	233	min.
1/2	Ext. Hyoscyamus	8	oz.
1-10	Oleoresin Capsicum	700	min.
1-10	Oil Peppermint	700	min.
	Calcined Magnesia	2	oz.
	Starch	8	oz.
	Sugar of Milk	1	lb.
	Total weight dry,	2½	lb.

(Not counting oil or oleoresin.)

Die, 9-32 inch. Weight, 2½ gr.

The oil peppermint and oleoresin capsicum should be mixed with sufficient bland oil to make 7,000 drops, and one drop put on each tablet.

Codeine, Alkaloid or Sulphate, 1-4 Gr.

1/4	Codeine, Alkaloid or Sulphate	4	oz.
	Cane-sugar	10	oz.
	Milk-sugar	6	oz.
	Total weight,	1¼	lb.

Die, 7-32 inch. Weight, 1¼ gr.

Cold, No. 3

2	Quinine Sulphate, Trit. (p. 136)	2	lb.
2	Dover's Powder	2	lb.
¼	Capsicum, powdered................	4	oz.
1	Tr. Aconite* =*.35 Fl. Ext*..........	5⅝	oz.
	Starch	14	oz.
	Acacia-starch-paste	12	oz.

Total weight dry, 5½ lb.

Die, ⅜ inch. Weight, 5½ gr.

Copper Arsenite, 1-100 Gr.

1-100	Copper Arsenite................	70	gr.
	Cane-sugar	10	oz.
	Milk-sugar.....................	4305	gr.

Total weight, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Corrosive Sublimate, 1-30 Gr.

1-30	Corrosive Sublimate, powdered....	233	gr.
	Ammonium Chloride, granular....	19½	oz.

Total weight, 1¼ lb.

Dissolve the corrosive sublimate in 2 ounces alcohol, and moisten the ammonium chloride with the solution. After drying, sift, and compress without lubricant.

Die, 7-32 inch. Weight, 1¼ gr.

* U. S. P., 1890.

Corrosive Sublimate, 1 Gr.

1 Corrosive Sublimate, powdered	1	lb.
Ammonium Chloride, granular	1	lb.
Total weight,	2	lb.

Treat as in Antiseptic, Wilson. Compress rather soft.

Die, ¼ inch. Weight, 2 gr.

Coryza

½	Camphor	8	oz.
½	Quinine Sulphate, Trit. (p. 136)	8	oz.
1-64	Morphine Sulphate	110	gr.
1-2000	Atropine Sulphate =		
	1-200 trituration, 10 = 1	35	gr.
	Starch	6	oz.
	Acacia	½	oz.
	Cane-sugar	7½	oz.
	Acacia-starch-paste	4	oz.
	Total weight dry,	2	lb.

Die, ¼ inch. Weight, 2 gr.

Cough, No. 2

1	Ammonium Carbonate	1	lb.
¾	Squill, powdered	12	oz.
¾	Senega, powdered	12	oz.
5	Tr. Opium, Camph., =		
	1-50 Opium, powdered	140	gr.
	1-50 Camphor	140	gr.
	1-50 Benzoic Acid	140	gr.
	1-50 Oil of Anise	140	min.

Saccharin	140	gr.
Milk-sugar......................	12	oz.
Talcum, powdered (lubricant)	2	oz.
Mucilage Acacia, 20 %............		q. s.

Total weight dry, 3½ lb.

Mix the squill, senega, opium, benzoic acid, saccharin, and milk-sugar, and granulate with the mucilage acacia. Dry, and sift (number 20). Dissolve the camphor in the oil anise and add to the above granulation. Reduce a sufficient quantity of ammonium carbonate to make one pound number 30 or 40 granule, free from powder which will pass through a number 50 sieve. Lubricate this with the talcum and mix with the granulation.

Die. 5-16 inch. Weight, 3½ gr.

Cough, No. 3

3	Tr. Sanguinaria* = *.45 Fl. Ext*...	3150	min.
1-16	Morphine Acetate..............	1	oz.
5	Wine Antimony=*1-50 Tartar Emetic*	140	gr.
q. s.	Syr. Wild Cherry = *Fl. Ext*......	1	pt.
	Starch........................	8	oz.
	Yellow Dextrin	6	oz.
	Cane-sugar....................	11	oz.
	Oil Bitter Almond, true.........	½	oz.

Total weight dry, 2 lb.

Evaporate the tincture and fluid extract (which must be free from glycerin) to soft extract. Mix in the previously triturated powders, granulate,

* U. S. P., 1890.

and dry. Mix the oil bitter almond with the lubricating oil and mix very thoroughly. The oil bitter almond contains the equivalent in hydrocyanic acid of the amount present in one pint average fluid extract wild cherry.

Die, 9-32 inch. Weight, 2 gr.

Cough, No. 4

½	Ammonium Chloride, powdered	8	oz.
¼	Cubeb, powdered	4	oz.
3	Fl. Ext. Wild Cherry	43¾	oz.
1	Terpin Hydrate	1	lb.
1-10	Ext. Liquorice	700	gr.
	Acacia, powdered	8	oz.
	Cane-sugar	10	oz.
	Milk-sugar	9	oz.
	Oil Bitter Almond, true	1⅜	oz.
	Total weight dry,	4	lb.

Proceed as in Cough, No. 3.

Die, 11-32 inch. Weight, 4 gr.

Creosote, 1-10 Min.

1-10	Creosote, beechwood	700	min.
	Cane-sugar	11	oz.
	Milk-sugar	11½	oz.
	Total weight,	1½	lb.

Granulate the sugars, and use the creosote as lubricant.

Die, 7-32 inch. Weight, 1½ gr.

Creosote, 1 Min.

1	Creosote, beechwood	$14\frac{5}{8}$ oz.
	Cane-sugar	$1\frac{1}{2}$ lb.
	Milk-sugar	$1\frac{1}{2}$ lb.
	Total weight dry granulation,	3 lb.

Granulate the sugars, dry, lubricate, and compress. Drop 1 minim creosote on each tablet.

Die, 5-16 inch. Weight, 3 gr.

Croup, Spasmodic

1-20	Ext. Cannabis Indica	350 gr.
1-20	Ext. Hyoscyamus	350 gr.
5	Tr. Opium, Camph., =	
	1-50 Opium, powdered	140 gr.
	1-50 Benzoic Acid	140 gr.
	1-50 Camphor	140 gr.
	1-50 Oil Anise	140 min.
5	Syr. Ipecac. = *.35 Fl. Ext.*	2450 min.
2	Ext. Liquorice	2 lb.
	Milk-sugar	$2\frac{3}{4}$ lb.
	Mucilage Acacia, 10 %	q. s.
	Total weight dry,	5 lb.

Reduce the fluid extract to soft extract, and add the solid extracts; add the opium and benzoic acid previously triturated with the milk-sugar. Moisten with the mucilage acacia sufficiently to granulate. When well moistened, mix in the ext. liquorice, and granulate. Add the camphor, dissolved in the oil anise, to the dry granulation. Compress soft.

Die, 11-32 inch. Weight, 5 gr.

Cystitis, No. 1

2	Boric Acid	2 lb.
2	Potas. Bicarb., powdered	2 lb.
1	Ext. Buchu (green)	1 lb.
1	Ext. Dog-grass	1 lb.
½	Ext. Corn Silk	8 oz.
½	Ext. Hydrangea	8 oz.
1-500	Atropine Sulphate — *1-50 trituration, 10 = 1*	140 gr.
	Starch	17 oz.
	Acacia	3 oz.
	Total weight dry,	7½ lb.

Triturate together all the powders except the potassium bicarb. Soften the extracts and evaporate on water-bath (preferably in vacuum-pan) until a small portion, when removed and cooled, is quite brittle. Then incorporate the powders (best in a hot mixer or vacuum-pan), pull apart into small pieces, and cool. Grind and powder. Mix with the potassium bicarb. in fine powder. Moisten with alcohol. Dry, sift, etc.

When apparatus is available, the following procedure is recommended: Instead of the extracts use

Buchu, No. 40	4 lb.
Dog-grass, No. 40	3 lb.
Corn Silk, No. 40	2½ lb.
Hydrangea, No. 40	2½ lb.

Mix and exhaust with 70 % Alcohol. Recover the alcohol, reduce the extract in a vacuum-pan, and complete as directed above.

Die, 7-16 inch. Weight, 7½ gr.

Damiana Comp.

2	Ext. Damiana	2	lb.
1-30	Phosphorus	233	gr.
1/4	Ext. Nux Vomica	4	oz.
	Starch	8	oz.
	Milk-sugar	4½	oz.

Total weight dry, 2½ lb.

Make granulation in the usual manner, omitting the phosphorus. Dissolve the phosphorus with the usual precautions in about 4 oz. chloroform (see p. 130), and add to the spread-out granulation. Stir lightly with spatula or scoop until the chloroform is evaporated, lubricate and compress at once, protecting as much as possible from air.

Die, 5-16 inch. Weight, 2½ gr.

Diarrhœa

1/4	Opium, powdered	4	oz.
1/4	Camphor, powdered	4	oz.
1/8	Ipecac, powdered	2	oz.
1/8	Lead Acetate	1167	gr.
1	Bismuth Salicylate, basic	1	lb.
	Starch	5¾	oz.
	Acacia-starch-paste	4	oz.

Total weight dry, 2¼ lb.

Die, 9-32 inch. Weight, 2¼ gr.

Diarrhœa, No. 2

1/8	Calomel	2	oz.
1-32	Ipecac, powdered	½	oz.

1-16	Camphor, powdered	1 oz.
1-16	Morphine Sulphate	1 oz.
1-16	Capsicum, powdered	1 oz.
	Cane-sugar	10 oz.
	Milk-sugar	4½ oz.

Total weight, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Digitalin, 1-100 Gr.

See Copper Arsenite, 1-100 gr.

Digitalis, Fl. Ext., 1 Min.

1	Digitalis, Fl. Ext.	14⅝ oz.
	Milk-sugar	17 oz.

Total weight dry, 1¼ lb.

In order to produce a green tablet the fluid extract should be reduced *in vacuo*. Also, the stronger the alcohol used in exhausting the drug, the greener the extract. Drying must be conducted quickly at low temperature, and the heat removed as soon as the granulation is dry.

Die, 7-32 inch. Weight, 1¼ gr.

Diuretic, No. 1

1	Digitalis, powdered	1 lb.
1	Ext. Buchu	1 lb.
1	Potassium Nitrate, powdered	1 lb.
1	Squill, powdered	1 lb.

Starch	1	lb.
Milk-sugar	4	oz.

Total weight dry, 5 lb.

Die, 11-32 inch. Weight, 5 gr.

Diuretic, No. 3

1	Digitalis, powdered	1	lb.
2	Potassium Nitrate	2	lb.
½	Extract Buchu	8	oz.
½	Ext. Scoparius	8	oz.
1	Oil Juniper Berries	14⅝	oz.
	Starch	1	lb.
	Milk-sugar	4	oz.

Total weight dry (without oil), 5 lb.

Drop one *minim* oil juniper berries on each tablet.

Die, 11-32 inch. Weight, 5 gr.

Dobell's Solution, 1 Oz.

7½	Sodium Bicarbonate	7½	lb.
7½	Sodium Borate	7½	lb.
1½	Carbolic Acid	1½	lb.
	Syrup	12	oz.

Total weight dry, 17¼ lb.

Mix the syrup with 16 oz. water and warm. Melt the carbolic acid and add to the syrup and water. Granulate the powders with the mixture.

Die, 9-16 inch. Weight, 17¼ gr.

To make Dobell's Solution, dissolve one tablet in sufficient water to make 7¾ dr. and add ¼ dr. glycerin.

Dover's Powder, 2 1-2 Gr.

2½	Dover's Powder	2½ lb.
	Granulate with 10 % Mucilage Acacia.	
	Die, 9-32 inch.	Weight, 2½ gr.

T. T. Form

2½	Dover's Powder =	
	¼ *Opium, powdered*	4 oz.
	¼ *Ipecac, powdered*	4 oz.
	Cane-sugar	6 oz.
	Milk-sugar	6 oz.
		Total weight, 1¼ lb.
	Die, 7-32 inch.	Weight, 1¼ gr.

Dyspeptic, Haworth

1-40	Strychnine Sulphate =	
	¼ *Trituration, 10 = 1* (p. 142)	4 oz.
⅛	Ipecac, powdered	2 oz.
¼	Rhubarb, powdered	4 oz.
⅛	Capsicum, powdered	2 oz.
	Cane-sugar	4 oz.
	Milk-sugar	4 oz.
		Total weight, 1¼ lb.
	Die, 7-32 inch.	Weight, 1¼ gr.

Emmenagogue, Improved

1	Ext. Cotton Root Bark	1 lb.
1	Ergotin	1 lb.
1	Ext. Black Hellebore	1 lb.
1	Aloes, Socotrine	1 lb.
1	Iron Sulphate, dried.................	1 lb.
¼	Oil Savine..........................	4 oz.
	Starch	1¼ lb.
	Yellow Dextrin	8 oz.
	Milk-sugar	8 oz.

Total weight dry (without oil), 6½ lb.

Reduce the mixed extracts, ergotin, and aloes, to brittleness (or nearly) on water-bath; or, preferably, *in vacuo*. Mix in the powders, cool, dry if necessary, and grind to number 16 granule. Then add about 1 ounce of the oil savine, and, after compression, spray on the balance.

Ergotin, 1 Gr.

1	Ergotin	1 lb.
	Starch..............................	6 oz.
	Yellow Dextrin	2 oz.
	Milk-sugar	4 oz.

Total weight dry, 1½ lb.

Die, 7-32 inch. Weight, 1½ gr.

Fever, Davis

⅕	Tr. Aconite * = *.07 Fl. Ext.....*	490 min.
1-10	Tr. Bryonia * = *.01 Fl. Ext.....*	70 min.

* U. S. P. 1890.

1-10	Tr. Belladonna * = *.015 Fl. Ext.*	105	min.
	Cane-sugar..................	9¾	oz.
	Milk-sugar	10	oz.
	Total weight dry,	1¼	lb.

Die, 7-32 inch. Weight, 1¼ gr.

Fowler's Solution, 5 Min.

5	Fowler's Solution, = *1-20 Potassium Arsenite*..........................	350	gr.
	Ammonium Chlor., granular	8400	gr.
	Total weight,	1¼	lb.

Dissolve the potassium arsenite in a little water and moisten the ammonium chloride with the solution. Dry and mix thoroughly. Compress without lubricant.

Die, 7-32 inch. Weight, 1¼ gr.

Gonorrhœa

1	Cubeb, powdered (No. 100) ..	1	lb.
1	Copaiba, Balsam (solidifiable)	1	lb.
¼	Iron Sulphate, dried	4	oz.
¼	Venice Turpentine	4	oz.
¼	Oil Sandalwood	4	oz.
1-10	Oil Wintergreen	700	min.
	Calcined Magnesia	8	oz.
	Starch	1½	lb.
	Milk-sugar	1	lb.
	Cane-sugar.................	1 lb. 7	oz.
	Acacia-starch-paste	12	oz.
	Total weight dry (without oils),	7	lb.

* U. S. P. 1890.

Reduce the copaiba and Venice turpentine to about one pound, on a steam-bath or over a low flame. Remove the heat and stir in the calcined magnesia. Cool, powder, triturate with the other powders, and granulate. Mix the oils sandalwood and wintergreen with sufficient bland oil, and put one drop on each tablet, or spray.

Die, 13-32 inch. Weight, 7 gr.

Guaiac Comp.

3	Res. Guaiac, powdered	3	lb.
1	Ext. Pokeroot	1	lb.
2	Potassium Iodide, powdered	2	lb.
1-100	Colchicine	70	gr.
1-100	Digitalin	70	gr.
	Starch	1½	lb.
	Milk-sugar	4	oz.

Total weight dry, 7½ lb.

Triturate all the powders except the potassium iodide together, and mix with the ext. pokeroot, previously warmed, and, if necessary, thinned with a little diluted alcohol. Dry, powder, and mix with the potassium iodide. Moisten slightly, by spraying with diluted alcohol. Mix, dry, and sift.

On account of the extremely high price of colchicine, some manufacturers use in its stead, its equivalent of assayed fluid or solid extract colchicum seed or root.

Die, 13-32 inch. Weight, 7½ gr.

Heart Stimulant

(See page 104.)

·$\frac{1}{4}$	Tr. Bellad.* = *3-80 Fl. Ext.*..	260	min.
2	Tr. Digitalis * = *3-10 Fl. Ext.*	2100	min.
2	Tr. Strophanthus *..........	30	oz.
1-100	Nitroglycerin = *1-10 10 %* sol.	700	gr.
	Starch	5	oz.
	Cane-sugar	6	oz.
	Milk-sugar	$11\frac{3}{4}$	oz.

Total weight dry, $1\frac{1}{2}$ lb.

Die, 7-32 inch. Weight, $1\frac{1}{2}$ gr.

Hepatica

$\frac{1}{8}$	Euoynmin....................	2	oz.
1-20	Podophyllin	350	gr.
$\frac{1}{8}$	Ipecac, powdered	2	oz.
$\frac{1}{8}$	Calomel	2	oz.
1-12	Aloin	583	gr.
	Cane-sugar	$3\frac{7}{8}$	oz.
	Milk-sugar	6	oz.

Total weight, $1\frac{1}{4}$ lb.

Die, 7-32 inch. Weight, $1\frac{1}{4}$ gr.

Heroin, 1-12 Gr.

1-12	Heroin	583	gr.
	Cane-sugar	10	oz.
	Milk-sugar......................	3792	gr.

Total weight, $1\frac{1}{4}$ lb.

Die, 7-32 inch. Weight, $1\frac{1}{4}$ gr.

* U. S. P. 1890.

Infusion, Buchu Comp.

120	Infusion Buchu (5 %) = *1½ Ext.*	1½	lb.
20	Tr. Hyoscyamus = *¾ Ext.*	12	oz.
6	Potassium Bicarbonate, powdered	6	lb.
	Starch	12	oz.
	Acacia	3	oz.
	Milk-sugar	5	oz.
	Total weight dry,	9	lb.

Follow procedure indicated under Cystitis.

Die, 7-16 inch. Weight, 9 gr.

Injection

2½	Alum, powdered	2½	lb.
2	Zinc Sulphate	2	lb.
½	Fl. Ext. Hydrastis (or ⅛ Ext. 2 oz.)	7⅞	oz.
	Milk-sugar	12½	oz.
	Cane-sugar	12	oz.
	Boric Acid, powdered (lubricant)	4	oz.
	Total weight dry,	5	lb.

Proceed as in Alum Comp.

Die, 11-32 inch. Weight, 5 gr.

Ipecac, Powdered, 1-2 Gr.

½	Ipecac, powdered	8	oz.
	Cane-sugar	12	oz.
	Total weight,	1¼	lb.

Die, 7-32 inch. Weight, 1¼ gr.

Iron, Arsenic, and Strychnine

1	Iron, Reduced	1 lb.
1-100	Arsenous Acid = *1-10 Trit. 10 = 1*	700 gr.
1-60	Strychnine Sulphate = ⅙ *Trit. 10 = 1*	1167 gr
	Cane-sugar	3383 gr.

Total weight, 1¾ lb.

Die, 7-32 inch. Weight, 1¾ gr.

Iron, Quinine, and Strychnine

½	Iron, Reduced	8 oz.
½	Quinine Sulphate, Trit. (p. 136)	8 oz.
1-120	Strychnine Sulphate = *1-12 Trit. 1 = 10*	583 gr.
	Starch	4 oz.
	Cane-sugar	1⅜ oz.
	Acacia-starch-paste	3 oz.

Total weight dry, 1½ lb.

Die, 7-32 inch. Weight, 1½ gr.

Lead Acetate, 1 Gr.

1	Lead Acetate	1 lb.
	Boric Acid, powdered	4 oz.
	Syrup, 3 vol. Water, 1 vol.	q. s.

Total weight dry, 1¼ lb.

Dry the lead acetate for several hours at about 110 F. Mix with 3 ounces of the boric acid and granulate. Lubricate with 1 oz. boric acid.

Die, 7-32 inch. Weight, 1¼ gr.

Lead and Opium Wash

5	Lead Acetate	5 lb.
¼	Ext. Opium, U. S. P.	4 oz.
4	Ammonium Chloride, granular	4 lb.
	Boric Acid, powdered	1 lb. 3 oz.
	Syrup, 3 vol. Water, 1 vol.	q. s.

Total weight dry, 10 lb.

Dry out the lead acetate at about 110° F. Mix with 2½ oz. of the ext. opium and 14 oz. of the boric acid, granulate and dry. Mix the ammonium chloride with the balance (1½ oz.) of the ext. opium, moisten just enough to produce uniform color, and dry. Mix the dry granulations, lubricate with the balance (5 oz.) of the boric acid, and compress. The ammonium chloride is used to increase the solubility of the lead acetate. Decomposition results when the salts are heated together, and hence the necessity for separate granulation.

Die, 7-16 inch. Weight, 10 gr.

Lithium Benzoate, 3 Gr.

3	Lithium Benzoate	3 lb.
	Milk-sugar	10 oz.
	Syrup, 3 vol. Water, 1 vol.	q. s.

Total weight dry, 4 lb.

Die, 11-32 inch. Weight, 4 gr.

Lithium Citrate, 5 Gr. Effervescent

(See p. 55.)

Manganese Dioxide, 1 Gr.

1	Manganese Dioxide, precip	1	lb.
	Starch	5	oz.
	Milk-sugar	2	oz.
	Acacia-starch-paste	2½	oz.

Total weight dry, 1½ lb.

Die, ¼ inch. Weight, 1½ gr.

Menorrhagic

3	Gallic Acid	3	lb.
1	Ergotin	1	lb.
½	Hydrastin	8	oz.
	Starch	12	oz.

Total weight dry, 5 lb.

Die, 11-32 inch. Weight, 5 gr.

Mercury with Chalk, 1-2 Gr.

½	Mercury with Chalk	8	oz.
	Cane-sugar	8	oz.
	Milk-sugar	8	oz.

Total weight, 1½ lb.

Die, 7-32 inch. Weight, 1½ gr.

Mercury (ic) Iodide, Red, 1-8 Gr.

⅛	Mercury (ic) Iodide, Red	2	oz.
	Cane-sugar	10	oz.
	Milk-sugar	8	oz.

Total weight, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Mercury (ous) Iodide, Yellow, 1-4 Gr.

¼	Mercury (ous) Iodide, Yellow	4	oz.
	Cane-sugar	12	oz.
	Milk-sugar	8	oz.
	Total weight,	1½	lb.

Die, 7-32 inch. Weight, 1½ gr.

Protect carefully from light throughout operation.

Migraine, No. 1

2	Acetanilid	2	lb.
½	Camphor, Monobromated	8	oz.
¼	Citrated Caffeine = ¼ *Alkaloid*	4	oz.
	Starch	8	oz.
	Milk-sugar	2	oz.
	Acacia-starch-paste	6	oz.
	Total weight dry,	3½	lb.

As citric acid reacts with acetanilid, liberating acetic acid, the alkaloid caffeine must be used.

Lubricant, talcum mixed with starch.

Die, 5-16 inch. Weight, 3½ gr.

Mixed Treatment

5	Potassium Iodide	5	lb.
1-30	Corrosive Sublimate	233	gr.
1-40	Arsenous Acid = ¼ *Trit. 10 = 1*	4	oz.

30	Syr. Sarsaparilla Comp. =	
	7 Fl. Ext. (free from glycerin) ..	6½ pt.
	Oil Wintergreen	Spray.
	Oil Sassafras....................	Spray.
	Starch	9 oz.
	Milk-sugar......................	8 oz.

Total weight, 7½ lb.

Reduce the fl. ext. and mix in the previously triturated powders, omitting the potassium iodide. Dry, grind, and powder. Triturate with the potassium iodide (preferably in a ball mill), moisten slightly with alcohol, dry, etc. Spray the compressed tablets.

Die, 11-32 inch. Weight, 7½ gr.

Mixed Treatment, No. 2

2	Potassium Iodide, granulated	2 lb.
5	Syrup Iron Iodide =	
	.67 Iron Iodide................	10¾ oz.
1-64	Corrosive Sublimate	110 gr.
2	Donovan's Solution =	
	{ *1-50 Mercuric Iodide (Red)*.....	140 gr.
	{ *1-50 Arsenic Iodide*	140 gr.
2	Tr. Nux Vomica = *1-25 Ext. powd.*	280 gr.

Total weight, 2¾ lb.

Triturate all ingredients, except the potassium iodide, together. Mix with the potassium iodide. Moisten slightly with alcohol. Dry, sift, and compress without lubricant.

Die, ¼ inch. Weight, 2¾ gr.

Morphine Sulphate, 1-4 Gr.

See Codeine Sulphate, ¼ gr.

Morphine Sulphate, 1-2 Gr.

½	Morphine Sulphate	8 oz.
	Cane-sugar	8 oz.
	Milk-sugar	4 oz.
	Total weight,	1¼ gr.

Avoid excess of water in moistening.

Die, 7-32 inch. Weight, 1¼ gr.

Morphine and Atropine

¼	Morphine Sulphate	4 oz.
1-150	Atropine Sulphate = *1-15 Trituration, 10 = 1*	467 gr.
	Cane-sugar	8 oz.
	Milk-sugar	3033 gr.
	Total weight,	1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Myalgic

2	Sodium Salicylate	2 lb.
2	Acetanilid	2 lb.
½	Citrated Caffeine = *1-4 Alkaloid*	4 oz.
½	Cerium Oxalate	8 oz.
	Starch	13 oz.
	Milk-sugar	6½ oz.
	Acacia-starch-paste	12 oz.
	Total weight dry,	6¼ lb.

Die, ⅜ inch. Weight, 6¼ gr.

Nausea

2	Bismuth Subnitrate	2	lb.
2	Cerium Oxalate	2	lb.
1-12	Cocaine Hydrochloride	583	gr.
	Starch	14	oz.
	Milk-sugar	6¼	oz.
	Acacia-starch-paste	8	oz.

Total weight dry, 5½ lb.

Dissolve the cocaine in about one ounce of water and mix with the paste before granulating.

Die, 11-32 inch. Weight, 5½ gr.

Nerve Tonic

1-10	Zinc Phosphide	700	gr.
¼	Ext. Nux Vomica	4	oz.
1	Iron, Reduced	1	lb.
	Cane-sugar	7½	oz.

Total weight dry, 1¾ lb.

Die, 7-32 inch. Weight, 1¾ gr.

Neuralgic, Brown-Sequard

⅔	Ext. Hyoscyamus	10⅔	oz.
⅔	Ext. Conium Fruit	10⅔	oz.
½	Ext. Ignatia	8	oz.
½	Ext. Opium	8	oz
⅓	Ext. Aconite	5⅓	oz.
¼	Ext. Cannabis Ind.	4	oz.
⅕	Ext. Stramonium Seed	1400	gr.
⅙	Ext. Belladonna	1167	gr.

	Starch	1 lb.
	Milk-sugar	1 lb.
	Yellow Dextrin	8 oz.
	Total weight dry,	5 lb.
	Die, 11-32 inch. Weight,	5 gr.

Neuralgic, Gross

2	Quinine Sulphate, Trit. (p. 136)	2 lb.
1-20	Arsenous Acid = *1-2 Trituration, 10 = 1* (p. 115)	8 oz.
1-30	Strychnine Sulphate = *1-3 Trituration, 10 = 1* (p. 142)	2333 gr.
1-20	Morphine Sulphate	350 gr.
½	Ext. Aconite Leaf	8 oz.
	Starch	10 oz.
	Acacia	2 oz.
	Total weight dry,	4 lb.
	Die, 11-32 inch. Weight,	4 gr.

Neuralgic Headache, Myers

5	Sodium Bromide, powdered	5 lb.
½	Citrated Caffeine = *1-4 Alkaloid*	4 oz.
1	Acetanilid	1 lb.
½	Ext. Hyoscyamus	8 oz.
1-50	Morphine Sulphate	140 gr.
	Milk-sugar	6 oz.
	Total weight dry,	7 lb.

Triturate the powders together and granulate with the extract, previously thinned by warming,

and, if necessary, by the addition of a small quantity of water. Usually, no lubricant is necessary.

Die, ⅜ inch. Weight, 7 gr.

Nitroglycerin, 1-100 Gr.

1-100	Nitroglycerin = *1-10 10% sol.*	700	gr.
	Cane-sugar	10	oz.
	Milk-sugar	4305	gr.

Total weight dry, 1¼ lb.

Granulate the mixed sugars with the nitroglycerin solution, adding water as necessary.

Die, 7-32 inch. Weight, 1¼ gr.

Normal Salt Solution

30.9	Sodium Chloride, C. P.	30.9	lb.

Die, ⅝ inch. Weight, 30.9 gr. (2 gm.)

Nux and Ignatia Comp.

1	Tr. Nux Vomica = *1-50 Ext.*	140	gr.
1	Tr. Ignatia = *1-40 Ext.*	175	gr.
5	Tr. Cinchona = *1-4 Ext.*	4	oz.
1	Tr. Matricaria = *1-10 Fl. Ext.*	700	min.
1	Tr. Gentian Comp. = *3-20 Fl. Ext.*	1050	min.
½	Tr. Calumba = *1-20 Fl. Ext.*	350	min.
1-300	Phosphorus	23	gr.
1	Aromatic Powder	1	lb.
	Starch	6	oz.
	Milk-sugar	4	oz.
	Acacia	2	oz.

Total weight dry, 2 lb.

Add the phosphorus to the dry granulation of the other ingredients as directed under Aphrodisiac (which see). It is advisable to add to the granulation a few drops of the oils representing the spices of the aromatic powder.

Die, 9-32 inch. Weight, 2 gr.

Nux and Pepsin

1-100	Nux Vomica, powdered	70 gr.
1-10	Pepsin (insoluble) powdered	700 gr.
	Cane-sugar	3605 gr.
	Milk-sugar	10 oz.
	Total weight,	1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Opium, Powdered, 1 Gr.

1	Opium, powdered	1 lb.
	Starch	4 oz.
	Total weight,	1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Opium and Camphor

¼	Opium, powdered	4 oz.
¼	Camphor	4 oz.
	Cane-sugar	2 oz.
	Milk-sugar	10 oz.
	Total weight,	1¼ lb.

Dry quickly at low temperature.

Die, 7-32 inch. Weight, 1¼ gr.

Opium and Lead Acetate

¼	Opium, powdered	4 oz.
¾	Lead Acetate	12 oz.
	Starch	5 oz.
	Boric Acid	2¼ oz.
	Acacia-starch-paste	4 oz.

Total weight dry, 1½ lb.

Die, 7-32 inch. Weight, 1½ gr.

Ox-Gall Comp.

1	Purified Ox-gall	1 lb.
1	Pancreatin	1 lb.
¼	Ext. Colocynth Comp.	4 oz.
½	Quinine Hydrochloride	8 oz.
⅛	Ext. Nux Vomica	2 oz.
1	Ext. Dandelion	1 lb.
	Starch	14 oz.
	Liquorice Root, powdered	4 oz.

Total weight, dry, 4½ lb.

Die, 11-32 inch. Weight, 4½ gr.

Papain Comp.

1	Papain	1 lb.
½	Willow Charcoal	8 oz.
2½	Sodium Bicarb.	2½ lb.
	Milk-sugar	2 oz.
	Cane-sugar	12 oz.
	Oil Wintergreen	2 dr.
	Mucilage Acacia 10%	q. s.

Total weight dry, 5 lb.

Add the oil wintergreen to the granulation.

Die, 5-16 inch. Weight, 5 gr.

Paregoric, 10 Min.

10	Paregoric, U. S. P. =	
	1-25 Opium, powdered	280 gr.
	1-25 Camphor	280 gr.
	1-25 Benzoic Acid	280 gr
	1-25 Oil Anise	280 gr.
	Milk-sugar	3455 gr.
	Cane-sugar	10 oz.
	Total weight,	$1\frac{1}{4}$ lb.

Add the camphor, dissolved in the oil anise to the dry granulation of the other ingredients.

Die, 7-32 inch. Weight, $1\frac{1}{4}$ gr.

Pepsin, 5 Gr.

5	Pepsin, insoluble, powdered	5 lb.
	Starch or milk-sugar	1 lb.
	Total weight,	6 lb.

Granulate with alcohol.

Die, $\frac{3}{8}$ inch. Weight, 6 gr.

Pepsin, Bismuth, and Charcoal

2	Pepsin, insoluble, powdered	2 lb.
2	Bismuth Subnitrate	2 lb.
2	Charcoal, wood	2 lb.
	Cane-sugar	1 lb.
	Total weight,	7 lb.

Die, $\frac{3}{8}$ inch. Weight, 7 gr.

Pepsin, Pancreatin Comp.

1	Pepsin, insoluble, powdered	1 lb.
1	Pancreatin	1 lb.
¼	Celery Seed, powdered	4 oz.
¼	Calcium Lactophosphate	4 oz.
	Milk-sugar	1 lb.
	Total weight,	3½ lb.

Granulate with alcohol.

Die, 11-32 inch. Weight, 3½ gr.

Pepsin Pancreatin Comp. No. 2

¾	Pepsin, insoluble, powdered	12 oz.
¾	Pancreatin	12 oz.
2	Bismuth Subnitrate	2 lb.
1	Sodium Bicarbonate	1 lb.
½	Ginger, powdered	8 oz.
1-12	Ext. Nux Vomica	583 gr.
	Milk-sugar	7 oz.
	Total weight dry,	5½ lb.

Granulate with diluted alcohol.

Die, 11-32 inch. Weight, 5½ gr.

Phenacetine, 5 Gr.

See Acetanilid, Aromatic.

Phenacetine and Salol

2½	Phenacetine	2½ lb.
2½	Salol	2½ lb.
	Starch	1¼ lb.
	Syrup	4 oz.
	Total weight dry,	6½ lb.

Granulate with 4 oz. syrup mixed with sufficient alcohol to thoroughly moisten. Dry at a temperature below 104° F.

Die, ⅜ inch. Weight, 6½ gr.

Placebo (Blank).

WHITE.

Milk-sugar	1 lb.
Cane-sugar	1 lb.
Total weight,	2 lb.

Die, 7-32 inch, with flat punches. Weight, 2 gr.

PINK.

Same as white with addition of Erythrosin D 15 gr. or Carmine Solution (p. 94) q. s.

BROWN.

Same as white with addition of Burnt Umber q. s.

YELLOW.

Same as white with addition of Alcoholic Tr. Curcuma (p. 95) q. s.

Podophyllin, 1-4 Gr.

See Aloin, ¼ gr.

Poke Juice, 2 Min.

2 Poke Juice = 2 *Trituration* (p. 132) ..... 2 lb.
Granulate with diluted alcohol.
Die, ¼ inch, or 7-32 inch with flat punches.

Weight, 2 gr.

Potassium Arsenite

See Fowler's Solution.

Potassium Bicarbonate, 5 Gr.

5 Potassium Bicarbonate, No. 16 .... 5 lb.
Lubricant usually unnecessary.
Die, 11-32 inch. Weight, 5 gr.

Potassium Bromide

See Ammonium Bromide.

Potassium Chlorate, 5 Gr.

5 Potassium Chlorate, No. 16 .... 5 lb.
(See p. 134)
No lubricant.
Die, 11-32 inch. Weight, 5 gr.

Potassium Chlorate and Borax

2½ Potassium Chlorate, No. 16 .... 2½ lb.
2½ Borax, powdered.................... 2½ lb.
Syrup, 3 vol. Water, 1 vol.......... q. s.

Total weight dry, 5¼ lb.

Granulate the borax with the syrup and water. Dry and lubricate with oil. Mix with the potassium chlorate gently.

Die, ⅜ inch. Weight, 5¼ gr.

Potassium Iodide, 5 Gr.

5 Potassium Iodide, granular............. 5 lb.
No lubricant.
Die, 9-32 inch. Weight, 5 gr.

Potassium Nitrate, 5 Gr.

5 Potassium Nitrate, No. 16 .... 5 lb.
No lubricant.
Die, 11-32 inch. Weight, 5 gr.

Potassium Permanganate, 1 Gr.

1 Potassium Permanganate, No. 20....... 1 lb.
Sift free from dust with number 50 sieve.
No lubricant. (See p. 135).
Die, 3-16 inch, or 5-32 inch. Weight, 1 gr.

Quinine Bisulphate, 2 Gr.

2 Quinine Bisulphate .... 2 lb.
Syrup, 3 vol. Water, 1 vol............. q. s.

Total weight dry, 2 lb.
Die, 9-32 inch. Weight, 2 gr.

Quinine and Capsicum

2	Quinine Sulphate, *Trit.* (p. 136)	2	lb.
½	Capsicum, powdered	4	oz.
	Starch	8	oz.
	Cane-sugar	7½	oz.
	Acacia, powdered	2	oz.
	Acacia-starch-paste	6	oz.

Total weight dry, 3½ lb.
Die, 11-32 inch. Weight, 3½ gr.

Quinine, Iron, and Arsenic

2	Quinine Sulphate, *Trit.* (p. 136)	2	lb.
1	Iron, Reduced	1	lb.

1-50	Arsenous Acid = *1-5 Trit. 10 = 1*	1400	gr.
	Starch	12	oz.
	Cane-sugar	5½	oz.
	Acacia-starch-paste	8	oz.

Total weight dry, 4½ lb.

Die, 11-32 inch. Weight, 4½ gr.

Quinine Sulphate, 2 Gr.

2	Quinine Sulphate, *Trit.* (p. 136)	2	lb.
	Starch	8	oz.
	Cane-sugar	7½	oz.
	Acacia, powdered	2	oz.
	Acacia-starch-paste	6	oz.

Total weight dry, 3¼ lb.

Die, 11-32 inch. Weight, 3¼ gr.

Rheumatic

7½	Sodium Salicylate	7½	lb.
2	Sodium Bicarbonate	2	lb.
2½	Wine Colchicum Seed* = *3-8 Fl. Ext.*	5½	oz.
q. s.	Oil Wintergreen	350	min.
	Starch	1¼	lb.
	Acacia	1	oz.
	Acacia-starch-paste	1½	pt.

Total weight dry, 11½ lb.

Die, ½ inch. Weight, 11½ gr.

* U. S. P. 1890.

Rhinitis, 1-2 Strength

¼	Camphor	4	oz.
⅛	Fl. Ext. Belladonna (Rt.)	875	min.
¼	Quinine Sulphate, *Trit.* (p. 136)	4	oz.
	Cane-sugar	6	oz.
	Milk-sugar	6	oz.

Total weight dry, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Rhubarb and Ipecac Comp., No. 2

2	*R*hubarb, powdered	2	lb.
¼	*I*pecac, powdered	4	oz.
1-20	*P*eppermint, Oil	350	min.
½	*A*loes, Socotrine, powdered	8	oz.
5	*N*ux Vomica Tr. = 1-10 Ext.	700	gr.
5	*S*odium Bicarbonate	5	lb.
	Curcuma, powdered	2½	oz.
	Tr. Shellac, 10% (p. 137)		q. s.

Total weight dry, 8 lb.

Granulate the rhubarb, 4 oz. aloes, and ext. nux vomica with water. Granulate the ipecac, 4 oz. aloes, soda, and curcuma with the tr. shellac. Dry separately. Mix and add the oil peppermint.

Die, 15-16 (or ½) inch. Weight, 8 gr.

Rhubarb and Ipecac Comp.

1	Rhubarb, powdered	1	lb.
5	Sodium Bicarbonate	5	lb.
1/8	Ipecac, powdered	2	oz.
1-20	Oil Peppermint	350	min.
	Starch	3	oz.
	Curcuma, powdered	2½	oz.
	Tr. Shellac, 10% (p. 137)		q. s.

Total weight dry, 6½ lb.

Granulate the rhubarb and starch with water. Granulate the soda, ipecac, and curcuma with the tr. shellac. Dry separately. Mix and add the oil peppermint.

Die, 3/8 inch. Weight, 6½ gr.

Rhubarb and Soda Comp.

1½	Rhubarb, powdered	1½	lb.
1½	Sodium Bicarbonate	1½	lb.
1-10	Oil Peppermint	700	min.
	Starch	3	oz.
	Curcuma, powdered	¾	oz.
	Tr. Shellac, 10 % (p. 137)		q. s.

Total weight dry, 3¼ lb.

Granulate same as in Rhubarb and Ipecac Comp.

Die, 9-32 inch. Weight, 3¼ gr.

Note.—On a small scale this tablet may be compressed without granulation. The powdered rhubarb and soda are mixed and compressed, and the oil sprayed on. See page 137.

Saccharin, 1-2 Gr.

½	Saccharin	8 oz.
	Milk-sugar	12 oz.
	Total weight,	1¼ lb.

Granulate with acacia mucilage, 10 %, and compress rather soft.

Die, 7-32 inch. Weight, 1¼ gr.

Saccharin, 1-2 Gr. with Soda

½	Saccharin	8 oz.
½	Sodium Bicarbonate, gran. (p. 140)	8 oz.
	Milk-sugar	4 oz.
	Total weight,	1¼ lb.

Granulate the saccharin and milk-sugar with mucilage acacia, 10 %. Mix the dry granulation with the sodium bicarbonate granulation.

Die, 7-32 inch. Weight, 1¼ gr.

Salicin, 5 Gr.

See Acid, Salicylic, 5 gr.

Salol, 5 Gr.

5	Salol	5 lb.
	Starch	1 lb.
	Syrup	8 oz.
	Alcohol	q. s.
	Total weight dry,	6½ lb.

Mix sufficient alcohol with the syrup to granulate the mixed powders. Dry at a temperature below 104° F.

Die, ⅜ inch. Weight, 6½ gr.

Santonin, 1-2 Gr.

½	Santonin	8 oz.
	Cane-sugar	10 oz.
	Milk-sugar	2 oz.
	Total weight,	1¼ lb.

Protect from light throughout operation.

Die, 7-32 inch. Weight, 1¼ gr.

Santonin and Calomel

½	Santonin	8 oz.
1-10	Calomel	700 gr.
	Cane-sugar	10 oz.
	Milk-sugar	175 gr.
	Total weight,	1¼ lb.

Protect from light.

Die, 7-32 inch. Weight, 1¼ gr.

Sedative

1	Ext. Valerian	1 lb.
1	Ext. Sumbul	1 lb.
1	Asafetida, Purified	1 lb.
	Starch	1 lb.
	Yellow Dextrin	8 oz.
	Milk-sugar	1¼ lb.
	Total weight dry,	5 lb.

Die, ⅜ inch. Weight, 5 gr.

Soda Mint

4	Sodium Bicarb., gran. (p. 140)	4 lb.
¼	Ammonium Carbonate	4 oz.
⅛	Oil Peppermint	1167 min.

Total weight without oil, 4¼ lb.

Grind sufficient ammonium carbonate to yield 4 ounces number 20 granule, free from powder which will pass through a number 50 hair sieve. Lubricate the soda granulation with about ½ ounce oil of peppermint and add the ammonium carbonate. Spray the compressed tablets with the balance of the oil.

Die, 5-16 inch. Weight, 4¼ gr.

Soda Mint, "Commercial"

5	Sodium Bicarb., gran. (p. 140)	5 lb.
q. s.	Oil Peppermint	½ oz.

Die, 5-16 inch. Weight, 5 gr.

This is the variety usually sold in bulk and in packages for retailing.

Sodium Arsenate, 1-10 Gr.

1-10	Sodium Arsenate, *Trit.* (p. 139)	700 gr.
	Cane-sugar	3675 gr.
	Milk-sugar	10 oz.

Total weight, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Sodium Benzoate

See Lithium Benzoate.

Sodium Bicarbonate, 5 Gr.

5	Sodium Bicarb., gran. (p. 140)	5 lb

Lubricant, oil.

Die, 5-16 inch. Weight, 5 gr.

Sodium Bromide

See Ammonium Bromide.

Sodium Phosphate, Dried

See Lithium Benzoate.

Sodium Salicylate, 5 Gr.

5	Sodium Salicylate....................	5 lb.
	q. s. Oil Wintergreen.................	Spray
	Starch..............................	12 oz.
	Gelatin (or best white glue)...........	12 oz.
	Total weight,	6½ lb.

Soak the gelatin in warm water (about 6 to 8 ounces) until dissolved, and granulate the mixed powders with it. When dry, sift out and reserve for a subsequent use all powder passing through a number 50 sieve. Lubricants, oil, 1 %; talc, 3 %; mixed with starch, 2 %.

Die, ⅜ inch. Weight, 6½ gr.

Sodium Salicylate Comp.

3	Sodium Salicylate.................	3 lb.
½	Ext. Colchicum Rt.................	8 oz.

1	Tr. Digitalis,* = *3-80 Ext.*	263	gr.
	Starch	14	oz.
	Acacia	3½	oz.

Total weight dry, 4½ lb.

Die, 11-32 inch. Weight, 4½ gr.

Sodium Sulphite Comp.

(Antiferment.)

1	Sodium Sulphite	1	lb.
1	Acid, Salicylic	1	lb.
⅛	Ext. Nux Vomica	2	oz.
⅛	Capsicum, powdered	2	oz.
1-10	Ipecac, powdered	700	gr.
	Starch	9	oz.
	Acacia	2	oz

Total weight dry, 3 lb.

Die, 5-16 inch. Weight, 3 gr.

Sodium Sulphocarbolate, 2 1-2 Gr.

2½ Sodium Sulphocarbolate, crystal, (no. 16 gran.) .... 2½ lb.

No lubricant.

Die, 9-32 inch. Weight, 2½ gr.

Sparteine Sulphate, 1-4 Gr.

¼	Sparteine Sulphate	4	oz.
	Cane-sugar	4	oz.
	Milk-sugar	12	oz.

Total weight, 1¼ lb.

Avoid excess of moistening agent.

Die, 7-32 inch Weight, 1¼ gr.

Stomachic

¼	Pepsin, insoluble, powdered	4 oz.
¼	Ext. Nux Vomica	4 oz.
¼	Charcoal, wood	4 oz.
¼	Capsicum, powdered	4 oz.
	Milk-sugar	5 oz.

Total weight dry, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Strontium Bromide

See Ammonium Bromide.

Strontium Salicylate

See Sodium Salicylate.

Strychnine Nitrate

See Acid, Arsenous.

Strychnine Sulphate

See Acid, Arsenous.

Sulphur, 5 Gr.

5	Sulphur, washed	5 lb.
	Starch	12½ oz.
	Acacia-starch-paste	8 oz.

Total weight dry, 6 lb.

Die, ⅜ inch. Weight, 6 gr.

Sulphur Comp.

5	Sulphur, washed	5	
2	Cream Tartar	2	
1-100	Ext. Ipecac	70	
1-500	Oleoresin Capsicum	14	m
1-1000	Acid, Arsenous = *1-100 Trit. 10 = 1*	70	[illegible]
½	Calcium "Sulphide"	2	o
	Starch	16½	o
	Acacia-starch-paste	12	o

Total weight dry, 8½ lb

Die, 7-16 inch. Weight, 8½ gr

Sun Cholera Mixture, 15 Min.

3	Tr. Opium, = *.23 Ext. U. S. P.*	1610	gr
3	Tr. Rhubarb, = *1-8 Extract*	2	oz.
3	Tr. Capsicum, = *1-50 Oleoresin*	140	min.
3	Sp. Camphor, = *3-10 Camphor*	2100	gr.
3	Sp. Peppermint, = *3-10 Oil*	2100	min.
	Starch	8	oz.
	Milk-sugar	12	oz.
	Acacia (in mucilage)	2	oz.

Total weight dry, without oil, 2 lb.

Spray or drop oil peppermint.

Die, 9-32 inch. Weight, 2 gr.

Syphilitic

2½	Potas. Iodide, granular	2½	lb.
1-40	Corrosive Sublimate	175	gr.
	Ammonium Chloride, granular	1575	gr.

Total weight, 2¾ lb.

Dissolve the corrosive sublimate in a little alcohol, and add to the mixed granular salts. Mix thoroughly, dry, and compress without lubricant. The ammonium chloride is used merely as an excipient to adjust the weight of the tablets to the nearest fourth of a grain.

Die, ¼ inch. Weight, 2¾ gr.

Tartar Emetic

See Copper Arsenite.

Terpin Hydrate

See Acid, Salicylic.

Terpin Hydrate and Codeine

2	Terpin Hydrate	2 lb.
⅛	Codeine Sulph.	2 oz.
	Starch	8 oz.
	Acacia-starch-paste	5 oz.
	Total weight dry,	2¾ lb.

Die, 9-32 inch. Weight, 2¾ gr.

Terpin Hydrate and Heroin

2½	Terpin Hydrate	2½ lb.
1-16	Heroin	1 oz.
	Starch	8½ oz
	Acacia-starch-paste	6 oz.
	Total weight dry,	3¼ lb.

Die, 5-16 inch. Weight, 3¼ gr.

Throat, Cocaine

1-12	Cocaine Hydrochloride	583	gr.
1-10	Oleoresin Cubeb	700	min.
½	Benzoic Acid	8	oz.
2	Potas. Chlorate, powdered	2	lb.
q. s.	Ext. Liquorice, powdered	8	oz.
	Cane-sugar	1 lb. 9½	oz.
	Tragacanth, powdered	4	oz.
	Total weight,	5	lb.

Mix the benzoic acid with the sugar and tragacanth. Moisten evenly with water in which the cocaine hydrochloride has been dissolved. While moist, mix in the powdered extract liquorice and potassium chlorate. Granulate and dry at low temperature. The potassium chlorate is liable to cause spontaneous combustion if overheated, and the granulation should be constantly watched, and removed from the drier as soon as possible. The oleoresin cubeb is, of course, added with the lubricating oil.

Die, 11-32 inch. Weight, 5 gr.

Throat Mentholic

1-35	Menthol	200	gr.
1-280	Cocaine Hydrochloride	25	gr.
1-80	Oil Anise	88	min.
1-12	Benzoic Acid	583	gr.
1-16	Eucalyptol	1	oz.
	Cane-sugar	4 lb. 13	oz.
	Total weight,	5	lb.

Dissolve the cocaine in water, mix with the sugar, and granulate. Warm the other ingredients together until dissolved, and use as a lubricant.

Die, 11-32 inch. Weight, 5 gr.

It is frequently desirable to make a tablet similar to this, but milder and larger. The cocaine is better omitted when the tablet is used to supply a popular demand.

1-50	Menthol	140	gr.
1-50	Oil Anise (or Wintergreen)	140	min.
1-12	Benzoic Acid	583	gr.
1-32	Eucalyptol	½	oz.
	Cane-sugar	9 lb. 14	oz.
	Total weight,	10	lb.

Die, ½ inch. Weight, 10 gr.

Tonic, Aiken

1	Quinine Sulphate, Trit. (p. 136)	1	lb.
⅔	Iron, Reduced	10⅔	oz.
1-50	Arsenous Acid = *1-5 Trit. 10 = 1*	1400	gr.
1-50	Strychnine Sulphate = *1-5 Trit. 10 = 1*	1400	gr.
¼	Ext. Gentian	4	oz.
	Starch	6	oz.
	Acacia	2	oz.
	Total weight dry,	2¾	lb.

Die, 9-32 inch. Weight, 2¾ gr.

Tonsilitis

½	Tr. Aconite, * = *7-100 Fl. Ext.*	490 min.
1-10	Tr. Bryonia, * = *1-100 Fl. Ext.*	70 min.
1-10	Tr. Belladonna, * = *3-200 Fl. Ext.*	105 min.
1-100	Mercuric Iodide, Red	70 gr.
	Cane-sugar	9⅝ oz.
	Milk-sugar	10 oz.

Total weight dry, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Tonsilitis Gargle

3	Sodium Salicylate	3 lb.
3	Sodium Bicarbonate	3 lb.
3	Boric Acid	3 lb.
1	Zinc Sulphocarbolate	1 lb.
q. s.	Oil Wintergreen	350 min.
	Syrup, 3 vol. Water, 1 vol.	q. s.

Total weight dry, 10½ lb.

Reserve 8 ounces of the boric acid for lubricant.

Die, ½ inch. Weight, 10½ gr.

Triple Bromides, 6 Gr.

2	Ammonium Bromide, granular	2 lb.
2	Potassium Bromide, granular	2 lb.
2	Sodium Bromide, granular	2 lb.

Total weight, 6 lb.

* U. S. P. 1890.

Dry thoroughly and compress warm without lubricant.

Die, 11-32 inch. Weight, 6 gr.

Two other strengths of Triple Bromides are in common use; $7\frac{1}{2}$ gr. ($2\frac{1}{2}$ gr. each) and 15 gr. (5 gr. each). The $7\frac{1}{2}$ gr. requires $\frac{3}{8}$ inch die; the 15 gr., 7-16 inch.

Triple Iodides

1-30	Mercuric Iodide, Red	233	gr.
1-40	Arsenic Iodide	175	gr.
1-12	Iron Iodide	583	gr.
	Ammonium Chloride, granular	$17\frac{3}{4}$	oz.

Total weight, $1\frac{1}{4}$ lb.

Triturate the iodides together with alcohol to a thin paste. Gradually mix in the ammonium chloride, adding sufficient alcohol to evenly distribute. Dry, sift, and compress without lubricant.

Die, 7-32 inch. Weight, $1\frac{1}{4}$ gr.

Triple Sulphocarbolates

2	Calcium Sulphocarbolate	2	lb.
2	Sodium Sulphocarbolate	2	lb.
1	Zinc Sulphocarbolate	1	lb.
	Syrup, 3 vol. Water, 1 vol	q. s.	

Total weight dry, $5\frac{1}{2}$ lb.

Die, 11-32 inch. Weight, $5\frac{1}{2}$ gr.

Triple Valerianates

1	Quinine Valerianate	1	lb.
1	Iron Valerianate	1	lb.
1	Zinc Valerianate	1	lb.
	Starch	15	oz.
	Cane-sugar	$11\frac{3}{4}$	oz.
	Acacia	2	oz.
	Acacia-starch-paste	8	oz.
	Total weight dry,	5	lb.

On account of the persistent and penetrating odor of the valerianates, the precaution should be taken to keep them away from other drugs, tablets, etc., as well as from unnecessary utensils.

Die, 11-32 inch. Weight, 5 gr.

Vaginal Astringent

2	Alum, powdered	2	lb.
2	Zinc Sulphate	2	lb.
2	Tannic Acid	2	lb.
1	Fl. Hydrastis, colorless, = *1-40 Hydrastine Sulphate*	175	gr.
3	Boric Acid	3	lb.
	Cane-sugar	$2\frac{1}{8}$	lb.
	Total weight dry,	10	lb.

Mix the powders, except the tannic acid and 8 ounces of the boric acid. Moisten with water, mix in the tannic acid, and granulate. Lubricate with the 8 ounces boric acid. Compress rather soft.

Die, 9-16 inch. Weight, 10 gr.

Viburnum Comp.

(See p. 112)

Warburg Tincture, 1 Dram

1	Ext. Aloes, aqueous *	1	lb.
7-16	Rhubarb, No. 40..............	7	oz.
7-16	Angelica Seed, No. 40	7	oz.
7-32	Elecampane, No. 40	3½	oz.
7-32	Saffron, Spanish, powdered.....	3½	oz.
7-32	Fennel = *1-50 Oil*	140	min.
7-64	Gentian, No. 40...............	1¾	oz.
7-64	Cubeb = *1-50 Oleoresin*	140	min.
7-64	Zedoary Root, No. 40..........	1¾	oz.
7-64	Myrrh, powdered..............	1¾	oz.
7-64	White Agaric, No. 40..........	1¾	oz.
7-64	Camphor	1¾	oz.
1¼	Quinine Sulph. Trit. (p. 136). 1 lb.	4	oz.
	Starch .... 1 lb.	4	oz.
	Milk-sugar	12	oz.

Total weight dry, 5 lb.

Mix the rhubarb, angelica seed, elecampane, gentian, zedoary, and agaric, and exhaust by percolation with diluted alcohol. Reduce to brittleness with the extract aloes, on water- or steam-bath. While still warm mix in starch and milk-sugar. Cool and reduce to fine powder. Add the saffron, myrrh, and quinine, and granulate. Dissolve the camphor in the oil and oleoresin and add to the dry granulation.

Die, 11-32 inch. Weight, 5 gr.

* or Purified Aloes

Zinc Phosphide, 1-10 Gr.

1-10	Zinc Phosphide	700 gr.
	Cane-sugar	10 oz.
	Milk-sugar	3675 gr.

Total weight, 1½ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Zinc Phosphide and Ext. Nux Vomica

1-10	Zinc Phosphide	700 gr.
¼	Ext. Nux Vomica	4 oz.
	Cane-sugar	7 oz.
	Milk-sugar	3675 gr.

Total weight dry, 1½ lb.

Die, 7-32 inch. Weight, 1¼ gr.

Zinc Sulphocarbolate, 1 Gr.

1	Zinc Sulphocarbolate	1 lb.
	Cane-sugar	4 oz.

Total weight, 1¼ lb.

Die, 7-32 inch. Weight, 1¼ gr.

INDEX.